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THE

Towne Scientific School Journal

January, 1914

Published by the

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CONTENTS
January, 1914

Cover Design
Frank M. Holcomb

Dr John Frazer 4

Foreword 5

Should An Engineer Be Broadly Educated 9
Prof. Robert H. Fernald

Solving The Problem of Human Engineering . . . 10
Coleman Sellers, 3d, M. E., 1915

Stewardson Traveling Scholarship 10

High Points In The History of Engineering . . . 11
Spencer Roberts, 3d, E. E., 1914

Growth of School of Architecture 14

The Honor System in the Department of Architecture . 15
A. G. Thorpe, Arch., 1914

Stewardson Traveling Scholarship 17

Drawing Room System 18
H. Lewis Williams, C. E., 1914

Underground Construction 25
R. B. Ferris, E. E., 1917

Editorial 31

Autumn Athletes 32

Alumni 35

Alumni Insert 36

Department News 38

Advertisements

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DR. JOHN FRAZER
Dean of the Towne Scientific School

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Towne Scientific School Journal

Vol. I JANUARY, 1914 No. 1

FOREWORD.

DR. FRAZER.

The broadening of the scope of the Whitney Engineering Magazine, under the name of the "Towne Scientific School Journal," to embrace the interests of all the students of the Towne Scientific School, marks a distinct step forward and will, it is hoped, have the effect of binding still more closely the various departments of the School into a compact unit which will foster the spirit of unity and co-operation throughout the School.

As an exponent of the many activities of the Towne Scientific School it should have the hearty support of both faculty and students from the beginning.

The students of the Mechanical and Electrical Engineering Departments, under whose auspices the Whitney Engineering Magazine was formerly edited and to whose interests it was devoted, are to be congratulated upon the broad-minded spirit they have shown in enlarging the scope of the periodical so as make it representative of the entire School rather than of an integral part of it.

May the "Towne Scientific School Journal" meet with the success which it justly deserves.

DR. JOHN FRAZER.

December, 1913.

SHOULD AN ENGINEER BE BROADLY EDUCATED?

By PROF. R. H. FERNALD.

(A modification of a paper presented before the Philadelphia Section of the American Institute of Electrical Engineers, November 10, 1913.)

Prior to the civil war the work of the engineer in this country was to a great extent that of the mechanic or artisan applying a trade. At that time civil engineering practically embraced all engineering work save that of the military engineer. Following the war the developments in transportation, manufacturing, power distribution, etc., accompanied by natural competition, created a demand for more thoroughly equipped engineers with specific training along scientific lines. This great demand for men of this type was met by the establishment of the Land Grant Colleges and technical institutions offering instruction in the specialized engineering branches demanded by the market of the day. The engineering graduate of the period was a well-trained specialist, but not necessarily a man of breadth of training.

The complexity of mere living has in the past twenty years increased at a tremendous pace, and the time has now come when the question of meeting the normal demands of daily existence hinges in large measure upon the engineer—not the artisan alone nor the scientific specialist alone, but the engineer of large affairs controlling and directing the great agricultural, mining, manufacturing and transportation projects.

The engineering profession, therefore, demands the services of the artisan, the technically trained man and the man of business initiative and capacity.

The trade school plays a peculiarly important role in training and educating men of the first class. Men of the second and third classes largely receive their education and foundational training through the opportunities offered by the technical schools and universities.

Although in many instances the career of a young man in college may be carefully and wisely directed by his father or some interested friend, the trend of the majority of students undoubtedly depends largely upon the aims and personal ideals of the student, the direction and aid given by the professors and

the element of chance common to all. Personality and intrinsic worth are in my estimation greater factors than education in determining real success. We all recognize that the closest application to business, even though it result in the highest efficiency, will not win desired opportunities for large responsibilities and coveted positions of power among men unless accompanied by a strong, pleasing personality, breadth of view and cultural development. Let us consider for a moment the four essentials mentioned—technical efficiency, personality, breadth of view and general culture.

The first—technical efficiency—may undoubtedly be acquired by the average student who faithfully pursues the engineering courses offered by the many technical schools and universities of the country and who consistently applies himself during a reasonable period following graduation.

The second quality—personality—is largely a matter of inborn characteristics beyond the control of the individual, but which to a certain extent may be cultivated by association and environment. Incidental to environment is mental attitude, which is greatly influenced by the character of reading and study.

The third essential—breadth of view—has much to do in developing those qualities which fit a man to tackle big things. In exceptional cases only is conspicuous breadth found in the product of the purely technical courses generally offered, and in these cases it is usually traceable to inherent qualities in the man or to unusual opportunities and associations after leaving college. The real foundation for breadth of view can best be laid during the formative period of the university student, when his mind is readily responsive to suggestion. To me this seems the logical time for the introduction of that broader foundation upon which I believe every man can build much more securely and with greater assurance as to the future than when restricted by the narrower confines of purely technical training.

The fourth attribute—general culture—is largely a question of early environment, education, and natural desire. Success, viewed from the financial standpoint alone, does not necessarily depend in any way upon culture—in fact, culture is often sadly lacking. Success in the larger sense—in the sense of greater attainments and the largest enjoyment of life—undoubtedly depends

to a marked degree upon cultural development. The academic work of the university unquestionably offers the most direct educational foundation in this field.

The combination of the academic courses with the more utilitarian courses of the engineering departments opens the way to a larger sphere of usefulness, success, and enjoyment to the young man of capacity than the limited engineering courses. The broader and deeper the foundations the higher the superimposed structure may be.

The purpose of a university course is effectively outlined by Dr. Washington Gladden as follows: "A course in a university has served its purpose if it has laid some good foundation on which future accumulations of experience may rest; if it has given some training in habits of investigation; if it has developed some power of appreciating the best in life and art; if it has laid down the lines on which study may be usefully continued; if it has lifted up and clarified some worthy ideals of conduct and service."

Two pertinent questions present themselves—

First—What men take this broader university course?

Second—What course should be recommended to a young man about to enter college?

My reply to the first query would be that there are two general classes of desirable students seeking an engineering education. The first class consists of those who have a definite inclination toward the mathematical and technical side, but who have little interest in or taste for the literary and more general but less utilitarian work offered by the arts courses.

The second class consists of those who really desire a technical course as their professional foundation, but who recognize the advantages of and have a taste for the broader and more general academic training.

Those of the first group naturally take the four-year engineering course, and in the second group there are always many who for lack of time or funds cannot see their way to take advantage of the larger opportunities. Both types of courses are, therefore, justified in a university.

The answer to the second question, viz., what course should be recommended to a young man about to enter college—depends to some extent upon the young man's financial condition. If

financial considerations do not enter into the question, my reply would be that if a young man has reasonable capacity and is an all-round student of fair ability, I should by all means advise him to take a complete academic course leading to the degree of A. B. and then follow this by the professional course. Further than this I should prefer not to attempt, save in exceptional cases, to determine the exact professional course to be followed until the young man is well established in his academic work and has had ample opportunity to familiarize himself with the details of such courses, to get in touch with the ideas of his associates, to discuss fully the future possibilities of the various fields and to readjust his own views and inclinations.

My somewhat rambling remarks may be summarized as follows:

1. In engineering pursuits there is need of three classes of men more or less broadly educated—the artisan, the engineer or technical specialist, and the all-round man of affairs and business capacity.

2. The educational institutions of the country offer opportunities designed to meet the requirements of each of the three groups mentioned through the trade school and technical institute, the four-year engineering university course and the broader academic course followed by the professional course.

3. Which of the two courses a man pursues at a university depends largely upon his early environment, calibre and taste, time and money at command, and, to some extent, to the direction or suggestion received after reaching the university.

4. My closing thought is best expressed in the words of a professor of modern languages in a purely technical institution: "Society needs men—men who think quickly and accurately, who feel strongly and generously; men of sound judgment and catholic temper; men with a fine sense of personal and professional rectitude; men who, as Governor Hughes said, are to be 'trustees of the future of a great country.' Rare men are these, the product of native endowment, of home environment, of the education of school and of life. No institution may send forth a large percentage of such, but every institution should try to."

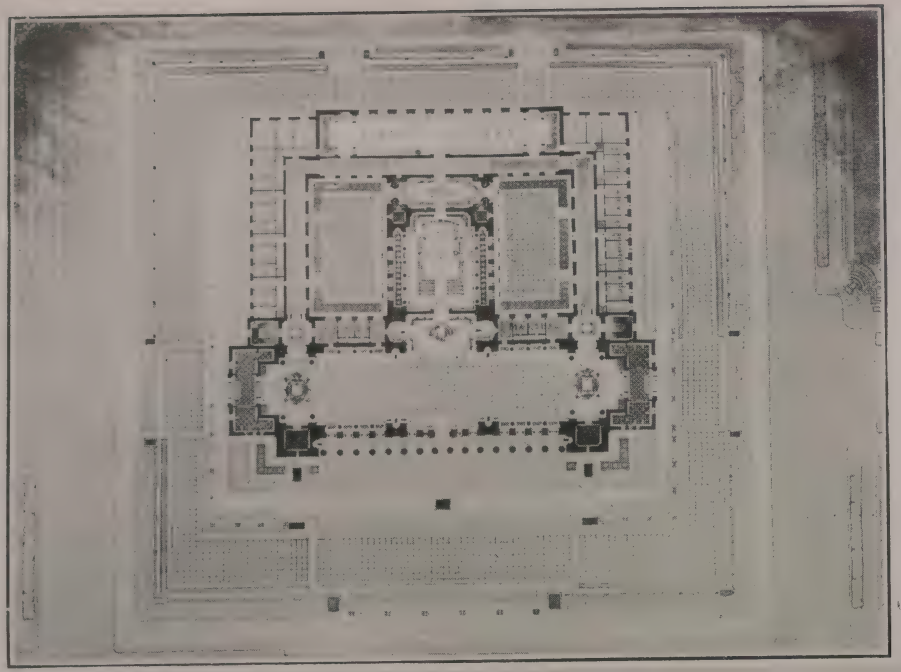
SOLVING THE PROBLEM OF HUMAN ENGINEERING.

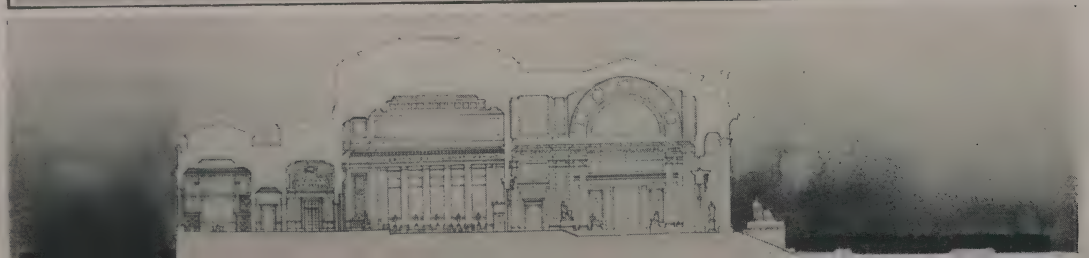
COLEMAN SELLERS, 3D, M. E., 1915.

The Industrial Service Movement, recently inaugurated in our University, deserves the careful consideration of every engineering student. It consists essentially of contact between the college undergraduate and the workingman, to the mutual benefit of both. Facts alone are sufficient proof of the success of the movement, for, since its beginning at Yale, six years ago, it has spread to 160 colleges and universities, scattered over the entire United States. At a conservative estimate, 3500 undergraduates are at present reaching 60,000 working men and boys each week in definite service. Many more are finding opportunity to do this work in the summer, and over 3000 graduates who became interested while in college are now extending the influence and promoting the ideals of the Movement in their larger spheres.

There is a wide range of activities dealing with industrial workers, so that the undergraduate is able to find some service which is agreeable to him, as well as beneficial. The fields in which this service is applied include the teaching of English, Civics, American History, Government, Industries, etc., to foreigners and mechanics. The Roberts Method enables this to be accomplished without the knowledge of any language but English on the part of the teacher. In some places talks are given on practical subjects, such as current events, health, travel, first aid to injured, etc. Observation trips to points of historic and civic interest are also undertaken. For English-speaking workers, classes in English, mathematics, mechanics, electricity, drawing, plan reading, etc., are organized and factory games and athletics superintended. The men are met on their own ground and the classes are held in the shops and factories at the noon hour or after closing time, or in foreign clubs, labor unions, settlement houses, etc.

That the work is appreciated is beyond a doubt. Education to the working man spells opportunity. Besides, it teaches him a better way to live and often keeps him from low amusements, thereby raising his efficiency and making him a better citizen. In one town, recently, labor leaders invited students who had been instructing classes of their men to attend one of their councils, which, I believe, is a sign of friendliness and respect not often





STEWARDSON TRAVELING SCHOLARSHIP
—1913

Prize Design by C. W. Stedman, P.G.

A Building for the
Supreme Court of the United States

Plan and Section

(Courtesy of The Alumni Register)

conceded to outsiders. Employers, too, are giving all the encouragement possible and are providing buildings, railroad cars, special rooms, etc., for the work.

Besides the help afforded the industrial workers, there is a decided benefit to the student. To come in contact with the working man and handle him successfully takes experience and knowledge not to be gained by work done in the classrooms and laboratories. This problem of "human engineering" is one which has long been neglected in the college curriculum, and yet is one which every student is some day going to meet. Here, then, is the very opportunity he desires. In this teaching of the working classes he gains an insight into actual working and living conditions. He comes to understand the industrial man not as a class, but as an individual, and, most important of all, he learns how to handle men intelligently and sympathetically. Not until a man graduates does he realize how valuable this experience is, no matter what his occupation. It also enlarges a man's vision and increases his sympathy with "the other half."

The time required for service in this Movement—from one hour a week to one or two evenings—is surely not great enough to interfere with studies to any great extent. The sacrifice of an engineer's time is well repaid in benefit to himself, to the industrial worker and the world in general.

HIGH POINTS IN THE HISTORY OF ENGINEERING.

SPENCER ROBERTS, 3D, E. E., 1914.

Many engineers ask themselves just when and how their respective professions originated, and to whom they are indebted for the high points in the subsequent development of engineering. Let us first quote "ingenium," the Latin origin of the word engineer, meaning "natural ability and capacity," and then the century-old yet unsurpassed definition of engineering by Tredgold, who described it as "the art of directing the sources of power in nature to the use and convenience of man."

Engineering might be said to have existed since the earliest time, and proof of this statement could be given in such examples as the Pyramids of Cheops, the old Roman roads and the hydraulic systems of that once supreme nation. The early undertakings

were very few in number, but mammoth in size. Such early scientists as Aristotle, Archimedes, Copernicus, Galileo, and Newton, were chief among those who paved the way for the fundamentals of modern engineering. The early development of engineering was chiefly along military lines, when all the energies were in matters of conquest, acquisition, and the like.

It was not, however, until the Nineteenth Century that engineering in its present sense really had its awakening. The invention of the steam engine by Watt (1763) was directly responsible for this. Oliver Evans had, in 1779, developed the high-pressure feature of the steam engine. The ever-increasing investigations and empirical application of scientific principles and discoveries were in themselves sufficient to stimulate the interest of a multitude in technical matters. This new phase was termed civil engineering to distinguish it from the sort practiced in warfare.

It was then that successful canal construction and operation began. In 1801 Trevithick operated the first steam locomotive. Fitch and Fulton (1807) followed closely with their steam-propelled boats, and the Atlantic Ocean was crossed by one in 1819. In 1825 the first railroad was in successful operation, Mathias Baldwin, an American, being at the top of locomotive builders.

Electrical engineering had its beginning around this time. Benjamin Franklin (1751) demonstrated that lightning consisted of discharges of static electricity, and Helmholtz later developed actual static machines. Michael Faraday delved into galvanic or current electricity, and his discovery of electro-magnetic induction in 1831 laid the foundation for the dynamo.

Mechanical Engineering was rapidly taking form, due chiefly to founding of modern science of thermodynamics by Carnot in 1824, and later investigations on the mechanical equivalent of heat by Jonle in 1843. Clausius, Rankin, and the late Lord Kelvin, went many steps further in this science. Neilson's invention of the hot blast furnace in 1828 was the beginning of the manufacture of wrought iron and steel, so generally employed in the great structures of to-day. Saint Vanant (1853) settled positively the laws of elasticity of beams. 'Squire Whipple (1847) made modern "bridge architecture" possible by his correct analysis of the stresses in framed structures. Railroads had now passed the

experimental stage, and with the aid of capital were now growing at a surprising rate.

The study of the application of re-enforcing to concrete was first begun by Lambot in 1850, followed shortly by Francis Coignet. Ernest Ransome, an American, was first to use metal for the above purpose. Samuel E. R. Morse, in 1835, invented a means of electrical communication, and Cyrus W. Field (1866) successfully linked the Old World with the New. Charles T. Porter brought out the first high-speed engine (150 R. P. M.) in 1862. English engineers declared such a material increase over the old 75 R. P. M. would be ruinous, but it resulted in much smoother running than the previous Corliss type. Condensing engines and steam indicators (Richards) were of previous development.

The greatest invention of the times was brought out in the form of the telephone by Berliner, Gray and Alexander Graham Bell in 1876, and has had the effect of revolutionizing business. Notable improvements in the design and construction of steam boilers were made around 1871, by Allen, Galloway, etc., and the former was responsible for the development of pneumatic appliances.

Internal combustion engines were first successfully operated by Robert Street in 1794, and later by W. L. Wright in 1833. Barsanti and Matteucci, in 1857, went still further, but real success was not attained until Otto and Langen developed their machine in 1867. Lenoir (1888) first applied them to his automobile, and the industry has augmented their development down to the present time.

The first steel building was constructed in 188— by W. L. B. Jenney, at Chicago, and rapid developments were to follow in steel fabrication, both bridge and building.

Thomas A. Edison, the invincible American, began a long series of inventions and investigations around 1870, notable among which was his incandescent lamp and his lighting systems. He is responsible for most of the methods of electrical distribution of to-day, and his later work in storage batteries and telephones is excellent. Van de Poole ran the first electric car in 1880, and thereby started another of the greatest of modern enterprises, the electric railway.

Elihu Thompson is the father of electric metering systems, and, together with Edwin J. Houstin, were the originators of much of the present system of arc-lighting. The first re-enforced concrete building was erected in 1877 by Thaddeus Hyatt, and ever since this remarkable agent has been utilized in increasing amounts for dams, conduits, canals, fireproofing and a host of other uses.

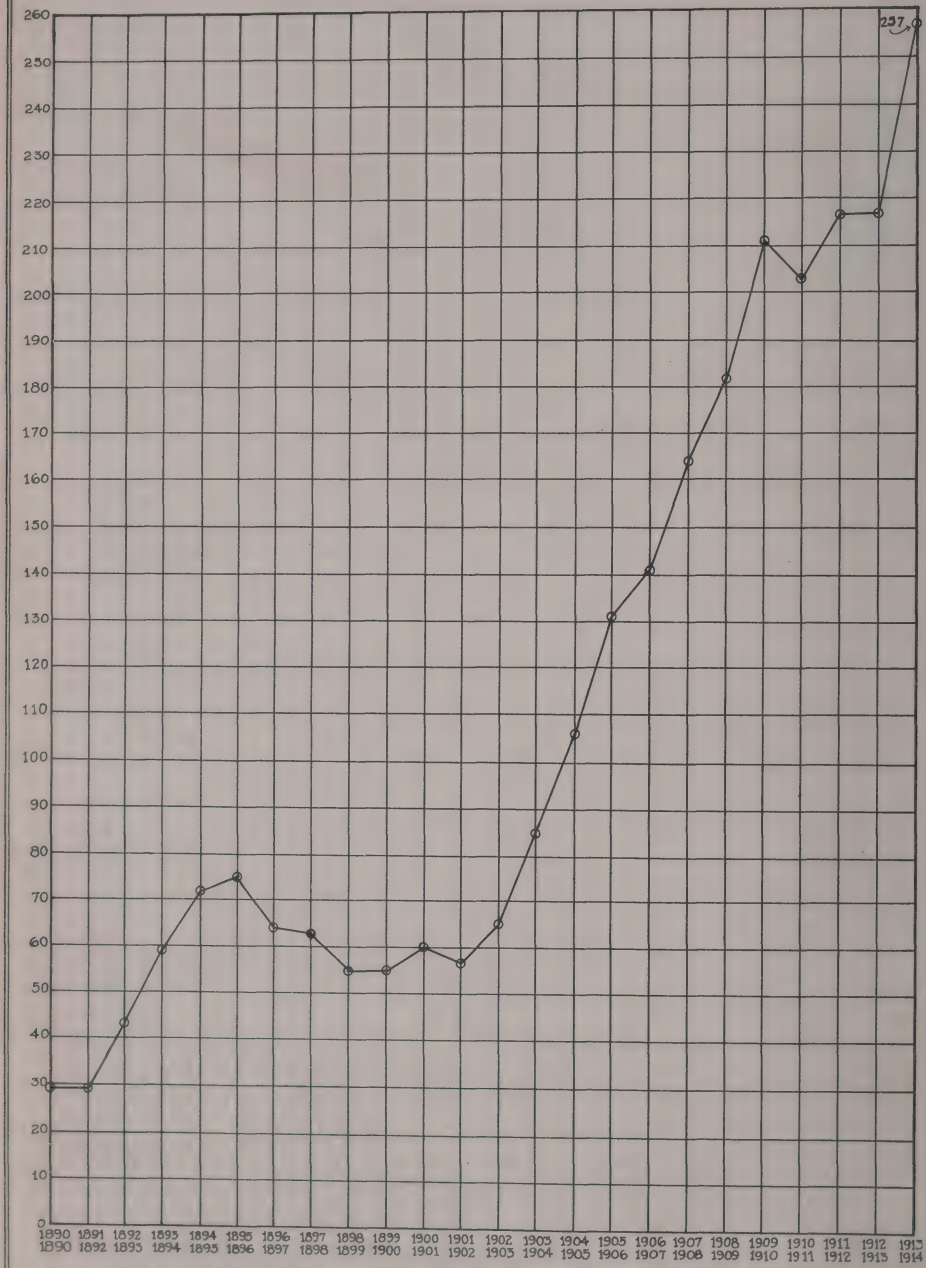
The steam turbine was a product of Parsons and De Laval in 1883, and the high efficiencies and small space required have placed the type of prime mover above all others for many classes of service. Rateau and Curtis are later designers.

Mining Engineering separated from Civil Engineering when the demand for coal, iron, copper and numerous other ores necessitated men specially trained in obtaining these. The exact date is indefinite, but it might be said to have been in the late sixties.

The establishment of engineering schools and societies are significant indices of the development, to a high professional plane, of the now numerous branches of engineering. Rensselaer Polytechnic Institute at Troy, N. Y. (1824), is, with the exception of West Point, the oldest school of its kind, either in England or America. The Massachusetts Institute of Technology was founded in 1859 by Professor William Barton Rogers. Mechanical Engineering as a distinct profession did exist until about 1850, and the phenomenal growth of electrical application necessitated the formation of distinct organizations for instruction in electrical engineering at nearly all of the important institutions now in existence.

The American Society of Civil Engineers was established in 1852, to be followed by the American Institute of Mining Engineers in 1871. Nine years later (1880) a similar organization of Mechanical Engineers was formed, and 1884 saw the birth of the American Institute of Electrical Engineers. Besides these four there are many other societies, consisting of special divisions or combinations of those already mentioned. Notable among these are The American Society for Testing Materials and The Illuminating Engineering Society.

During the past few years even greater specialization is noticeable. Chemical, Metallurgical, Sanitary, Illuminating, Efficiency and Commercial Engineering are examples of these, all



SCHOOL OF ARCHITECTURE — UNIVERSITY OF PENNSYLVANIA

DIAGRAM OF GROWTH

AT A SCALE OF TEN STUDENTS PER ANNUM

NOTE

This does not include attendance upon certain courses of study allied to and conducted at various times by the School of Architecture, as Interior Decoration, Water Color, & Design. Students taking Fine Arts in College not included.

THE SCHOOL OF ARCHITECTURE AT THE UNIVERSITY HAS FOR SEVERAL YEARS BEEN THE LARGEST IN AMERICA

(THIS EXCLUDING ATTENDANCE ON ENGINEERING CORSES IN ARCHITECTURAL SCHOOLS)

of which are, however, based upon the same fundamental sciences and differ only in their respective applications. Military Engineering likewise has been no laggard in this press of development. The modern methods of coast and field fortifications, gunnery, reconnaissance and communication are overseen by the best men of whom the world of engineering can boast.

And now in these present days of Engineering history is being rapidly made, such men as Charles P. Steinmetz, the broadest in Electrical Engineering; Dr. Diesel, Colonel George Goethals, of Panama Canal fame; B. G. Lamme, C. O. Mailloux, the authority on Electric Railways and Power Plants; Elihu Thompson and many others, stand out as beacons.

In ending mention alone need be made of the brilliant progress in engineering during the last decade, and the future can scarcely be conceived even by the most scientifically imaginative.

THE HONOR SYSTEM IN THE ARCHITECTURAL DEPARTMENT.

A. G. THORPE, Arch. '14

Most honorable citizens regret that it is ever necessary to reduce honor to a system; and it is with regret for its necessity, and a great hope for its success, that the problem of establishing an honor system, in the Architectural Department, was approached. Its necessity was clearly established by the prevalence of unfairness of various forms which are clearly enumerated in "The Code of Principles," given in another part of this article. Unfairness became so aggravated last year that the faculty were ready to act stringently in an attempt to correct it, when a movement was commenced by the Architectural Society, under the able leadership of G. Edward Brumbaugh, who was then president of the Society, to raise the standard of fairness and honesty among the men of the department.

A committee was appointed to study the subject of honor systems, with the view of presenting one to the student body for adoption. There was little unity among the members of this committee regarding the adoption of any system which required repeated pledges on the part of the individual, because it seemed

to assail the honor of a man every time a quiz was taken, and held him for only one form of unfairness, and mildly assumed that he would "crib" if he was not compelled to give his word each particular time. After much study and many compromises the committee finally agreed upon a system which seemed to cover all forms of unfairness and did not seem to assail the self-respect of the individual.

It was presented to the student body in a mass meeting and thoroughly explained by Mr. Brumbaugh, and after a brief discussion was adopted by a three to one vote; but before going into effect the faculty required the signatures of 75 per cent. of every class, as a pledge of good faith.

A man signs just once for his whole stay at the University. The big feature of the system is "The Code of Principles," the virtue of which no one can assail. They are as follows:

Code of Principles of the School of Architecture of The University of Pennsylvania.

We, the students of the School of Architecture of the University of Pennsylvania, in order to encourage an honest attitude on the part of the student towards his work, have formulated and do subscribe to this principle:—

That as gentlemen and professional men, we believe that it is dishonorable

1—To in any way evade rules or regulations governing esquisses.

2—To receive credit for work traced, copied, or otherwise fraudulently obtained.

3—To violate library regulations; or to monopolize, by concealment or otherwise, photographs, books or documents intended for general use.

4—To fail to return borrowed documents, instruments or materials.

5—To obtain illegitimate credit for attendance upon recitations, lectures or studio work by;

(a) Answering for another student at roll call;

(b) Being answered for by another student at roll call;

(c) Evading in any other way full and required attendance.

6—To submit for credit any written work which has been copied or otherwise fraudulently obtained.

7—To procure, impart or receive advance information concerning the questions of any written test.

8—To impart or receive, verbally or otherwise, during recitation or written test, information concerning the work in progress.

9—To make use of forbidden documents or other written or printed information during recitation or examination.

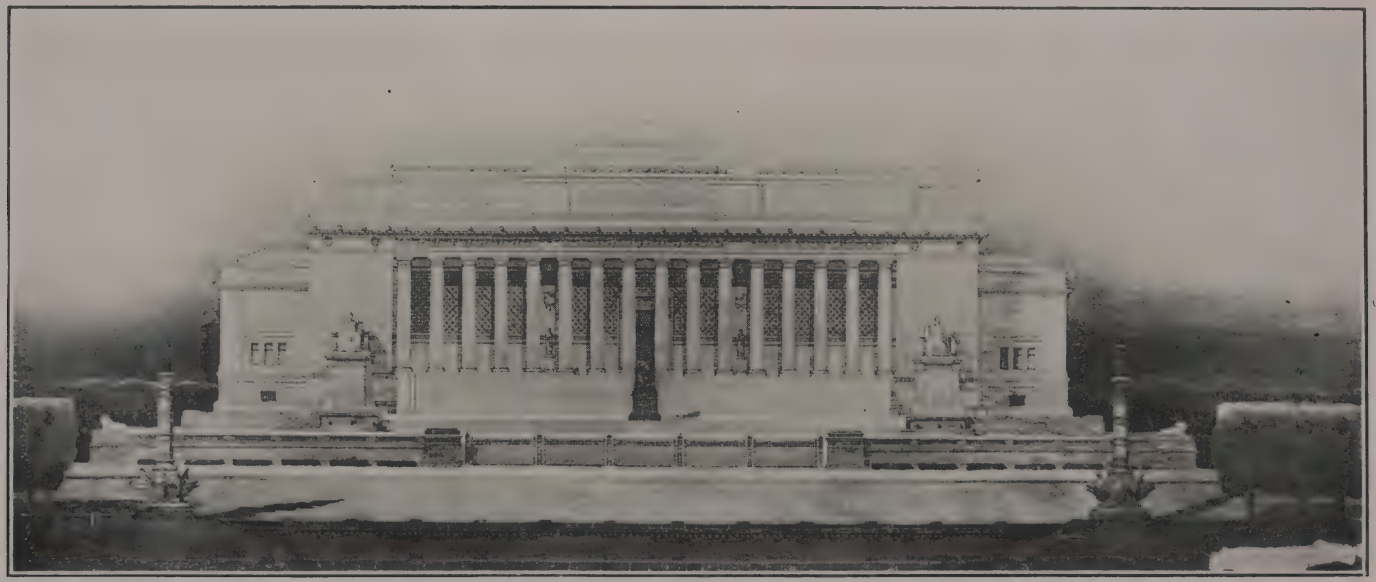
The students have almost unanimously expressed their sympathy with this code and their intention to stand by it, 98 per cent. having attached their signatures to it.

Each class is represented in a committee of students, known as the "Honor Committee," which interprets the "Code," tries the violators and recommends punishment. The present committee is as follows:

W. H. Tusler, '14, chairman.
J. H. Chillman, Jr., P. G.
R. J. Richardson, '14.
H. S. Harvey, '14.
E. G. Conrad, '15.
J. M. Green, '16.
G. A. Maass, '17.
R. W. Tempest, 2nd Year Special.
O. T. Lang, 1st Year Special.

The great hope in the whole idea is to establish a spirit of fairness in the department which will throw the man into disfavor who will not work and who tries by unfair means to attain honor with those who have worked.

It is not merely to eliminate aggravated instances of shame, but foster and nourish a spirit worthy of Pennsylvania and her leaders of today and yesterday, that we are trying this experiment.



STEWARDSON TRAVELING SCHOLARSHIP—1913

Prize Design by C. W. Stedman, P.G.
A Building for the Supreme Court of the United States
Facade on Capitol Square

(Courtesy of the Alumni Register)

DRAWING ROOM SYSTEM.

H. LEWIS WILLIAMS, C. E. 1914

This paper is an endeavor to bring up the major and most of the minor details of the drawing-room system employed by The Baldwin Locomotive Works, a concern which employs over three hundred men in the drafting rooms.

Every order for a locomotive is accompanied by a set of specifications which are made out on standard forms. The order is passed from the general offices to the chief draftsman, who allots the work to one of the fifteen or twenty designers.

The designer, guided by the specifications, lays the engine out to a scale of 1½ or 2 inches per foot, upon high-grade, heavy, mounted paper, using 7 or 8 H. pencils sharpened to wedge points. The designer works at a table such as shown in Figure I, this being a table of exceedingly comfortable and convenient dimensions. The designer is also assigned one or more long flat drawers in a cabinet close to his table, for the storing of his engine drawings. After such lines as the rail line, center line of boiler, and the boiler plates have been laid down with a long straight edge, all the other straight lines are executed with a pair of sixty-degree triangles; eight-inch triangles being a popular and convenient size.

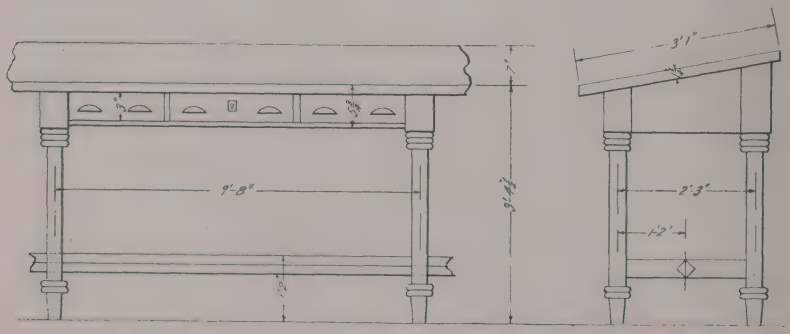


Fig. 1

The designer, as a rule, has an assistant, who does considerable work upon the engine drawing and keeps in touch with the details of the job, so that he can answer queries or carry on the work in the absence of the former.

The time required to get an engine through the drawing

rooms varies from a few hours, for a duplicate job, to two or three months for a large new type.

When a good start has been gotten on the drawing, the designer secures the aid of as many detailers (this word being used for draftsmen doing detail work, the word draftsman being generally applied to the designers) as may be required.

The detailer is assigned a certain piece of work and he takes his data from the drawing, either in the shape of dimensioned sketches or an accurate paper tracing. The latter seems to have the advantage of greater completeness, since, if well made, this paper tracing is as reliable as the original drawing and saves the time and annoyance attendant upon the former method, since the detailer will, almost invariably, omit necessary figures in making rough sketches and this means additional trips to the drawing.

The detailer has a table similar to Figure I, but not quite so long. Using the data obtained, the detailer lays down the work on a good grade of white drawing paper to one of several standard scales, 2 inches per foot being the most frequently used. No dotted lines are employed on the engine drawings, and after a little experience a detailer will find it but a waste of time to dot in the various hidden parts. By the time a man has looked thoroughly into a casting or forging and sees how it is used on the engine and then lays this work out, it is no hardship to trace the work direct from a solid line drawing.

Drawing paper is kept cut to certain sizes and the detailer obtains all necessary paper from a clerk. This method insures a minimum waste. After the pencil drawing has been made, it is well to have it referred to the designer, who will, in all probability, detect any inconsistencies. The detailer then obtains a piece of tracing cloth, the "size" being governed by the standard dimensions adopted by the company. The tracing cloth is kept cut in these standard sizes with borders, cutting lines and the wording given below printed on. The tracing is made with a standard water-proof India ink, each man being furnished with a small bottle, which is refilled from time to time at the supply room.

In the upper right-hand corner of each tracing is printed the wording referred to above: "This drawing in design and detail is our property and is to be used only in connection with

our work. All rights of design or invention reserved. The Baldwin Locomotive Works, Phila., U. S. A."

The title of the drawing is placed in the upper left-hand corner, and immediately under this the name of the detailer and date. A heavy straight-line letter is used for titles. Outside of the border in the lower right-hand corner is placed the classification of the engine for which the tracing has been made.

The Baldwin Locomotive Works' notation employs figures and letters to indicate the number of wheels of different kinds and the size of cylinders. A locomotive having one pair of driving wheels is classed as "B," that with two pairs, "C," with three pairs, "D," with four pairs, "E," and with five pairs, "F." The letter "A" is used for a special class of high-speed locomotive with a single pair of driving wheels, and for a smaller type used for rack rail service. In articulated locomotives a letter, as above, is used to designate the number of driving wheels in each group. A figure is used as an initial to indicate the total number of wheels under the locomotive, and the letter, as stated above, indicates the number of driving wheels. The size of the cylinder is represented by a number, which is found by subtracting 3 from the diameter of the cylinder in inches and multiplying the remainder by 2; thus a 19" cylinder would be represented by the number 32, so that a Mogul locomotive with 19" cylinders may be termed an 8-32-D. Conversely, the size of a cylinder may be obtained by dividing the class designation by 2 and adding 3.

When there are trucks at both ends of the locomotive, the fraction ¼ is placed after the cylinder number, and when there is a truck at the rear and none at the front, the fraction is 1/3. Thus a Mikado type locomotive with 19" cylinders would be a 12-32-¼-E, and one of the Forney type would be 8-32-1/3-C.

The same rule is carried out in the classification of compound locomotives. In this case, however, a number is given to indicate the diameter of each cylinder, that indicating the high pressure being written over the low pressure. Thus, 10-22/42-D-100 indicates a compound locomotive with ten wheels in all, having high pressure cylinders 24" in diameter, with three pairs of driving wheels and the one hundredth locomotive of its class.

This final figure indicating the class number of the locomo-

tive is used in connection with all engines regardless of the types to which they belong. (Quoted from "Locomotive Data" published by The Baldwin Locomotive Works 1912.)

In the upper right-hand corner, just within the border, the detailer notes the time it took him to draw the work and the time required for tracing.

After the tracing has been completed it passes under the observance of two drawing room foremen, who approve the tracing by stamping their initials in the upper right-hand corner. The tracing then goes to a clerk, who numbers the same and enters the title, classification, and detailer's name in record books.

The tracing is then handed over to the chief examiner, who passes it on to one of the dozen or more examiners. The examiner, after reading the specifications for the particular part of the locomotive checks the tracing from the engine drawing. After it is seen that Baldwin practice and laws have been abided by, the tracing is returned to the detailer to make whatever corrections or alterations may have been marked in soft pencil. After these alterations have been made, all pencil marks are erased, by the examiner, and his mark is placed upon the tracing, which then goes to the blue-print room.

The examiners constitute, in a manner, one of the separate departments of the drawing room. Likewise, there are individual groups which handle special branches of the work. One group does all the weight estimating, most of which work is accomplished with planimeter and slide-rule. Another department does the figuring upon all questions of strength of materials. Extra orders are handled by a separate group. Probably the most distinctive department is the clerical. Here a number of bookkeepers and stenographers attend exclusively to the writing up of records. Each engine has a card sheet, forging sheet, pattern sheet, brass work sheet, store-room sheet, and specifications. When the engine has been completed in the drawing room, these sheets are turned into the clerical department, where they are typewritten in the form of book-pages. These pages are bound in loose leaf form until a sufficient number of pages has accumulated to constitute a book and then it is sent to a bindery.

In the "blue room" at lease two prints are made—a "shop card" and a "book drawing." The former is a blue line print;

this is mounted on a heavy card and then varnished. The varnish forms a protection from the oil and grease coincident with handling in the shops. This varnishing is quite essential since many times the card is returned to the drawing rooms for revisions. When alterations are to be made upon the card, the varnish is cleaned from the surface by scrubbing with alcohol. The clean print is then altered in "fresh ink."

"Fresh ink" is the term applied to ink made by grinding Chinese stick ink in a small portion of water. After this stick of ink has been ground into water for about thirty minutes, it forms a good thick black solution which has the required peculiar property of being insoluble in alcohol, a property which is absent in ordinary drawing ink. All additions made to shop cards must be made in fresh ink so as to provide against future washings.

This ink is called "fresh" for the length of a day or probably two days at the most, after which time it looses its insoluble property and is then no better than ordinary ink. When this stage has been reached, the Chinese ink acquires an offensive odor.

Some trouble has been experienced from flies eating ink from a tracing. This can be remedied by the addition of a couple drops of gall to the ink.

A solution of soda is sometimes used for marking on blueprints, but owing to the fact that frequently this proves effective for a period only, it is generally held as poor practice.

The book which is prepared in the blue-print room is generally a blue line print made upon a heavy paper, a four-size page being valued at about sixteen cents.

The shop card is sent to the card room, where it is recorded and then sent to whichever shop is to do the work. The book drawing is sent to a clerk, who gives the print a page number and binds it in the proper book.

At the same time a new page is placed in a book, the number of the card or cards upon that page is indexed in the front of the book and also in small index books which are kept in a cabinet convenient to the book racks. This is necessary on account of the numbers of books which contain a single title. For example, grates are filed in eleven book, but after book 11 comes 11A, 11B, 11C, and so on down until all the letters of the alphabet have been

exhausted and then there is book 11K1, 11K2, on down to 11K9. A full book contains about 100 pages, thus representing about sixteen dollars worth of prints. These books are arranged in order in racks.

The book drawings are used instead of the tracing, for all reference work, and thus the tracings, many of which are quite valuable, are preserved. If a draftsman desires to see a certain card, he first refers to a revolving index of the Rand type; from this he learns in which of the couple hundred books the drawing is contained. For example, if he desires to see Frame No. 2230, he sees that frames are in book No. 48. He then goes to the small index book No. 48 and under No. 2230 is given the letter and page of the book.

When the books are taken from the racks, the name of the person who takes the same is entered upon a slate, opposite the number of the book. The books are collected each night and replaced in the racks.

A very convenient method of locating the men is to have all the tables numbered and an alphabetical list of the men with the number of their place opposite their name. A chart of the room is used in conjunction with this list, thus affording a means of finding the men speedily.

When the blue-print room has finished with the tracings, they are sent to the tracing vault, where a number of men do nothing but index and file them. The index number is inked in one of the lower corners of the tracing. Whenever it is essential for a draftsman to secure a tracing, he obtains the same by sending a note, with the O. K. of the drawing-room foreman, to the vault and the tracing is sent to him. The note is filed in place of the tracing and remains there until the tracing has been returned. All tracings and many other valuable records are kept in fireproof vaults.

The drawing-room foremen who have been referred to are the bosses of the several rooms. These are men who are thoroughly acquainted with the details of the drawing-room practice and their duties include the supervision of the men in their respective rooms.

In addition to the cards, a great many pattern tracings are made, the number up to the present writing being about 135,000.

Forgings also require detail tracings (sketches), these being made upon cloth cut to the size shown in Figure 2. The sketches total to date about 273,000. The record prints are filed in a similar manner to the cards, the patterns, however, being placed in number two size books. The sketches are printed six to a four size page and each contains 1000 prints. Many sketch tracings require but a few minutes to execute. Printed forms such as shown in Figure 2 being supplied for all the regularly forged parts of the engine. In many instances a new card varies so slightly from a former job that it is not necessary to make a new tracing. In such a case tabling is resorted to.

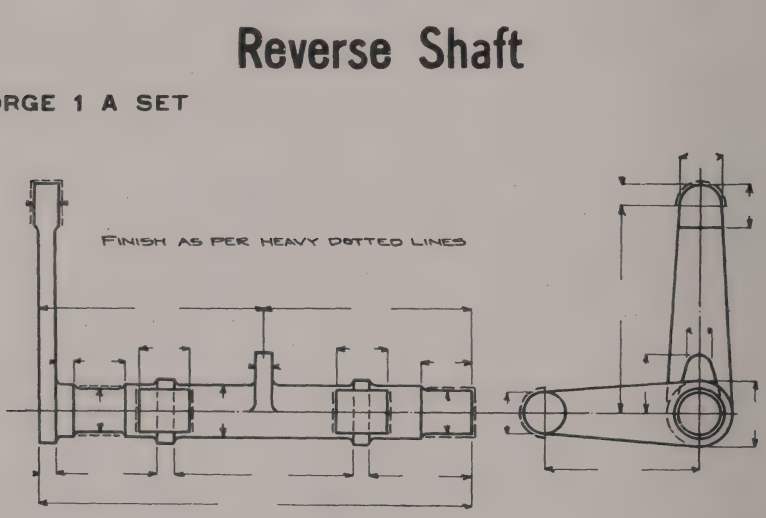


Fig. 2

Probably the greatest innovation which has been given a trial in the system of these drawing rooms was the establishing of what is known as the gang or group system. Originally, a great number of gangs were formed, each of which had its foreman an specialized on some one part of the engine. There was a gang for frames, cylinders, ash pans, grates, and probably others. This system, as viewed from the Company's standpoint, is a very excellent one. In the first place, it is difficult for a designer to keep in mind the numerous laws which have accumulated day by

day to govern the design of details, whereas a group of men spending all their time on but one part become thoroughly familiar with these laws, and as a result the laws are given due consideration. Secondly, a group man, in time, becomes quite efficient on this particular part and each successive job he turns out approaches closer to perfection. Thirdly, the designer is relieved of the greater burdens of the work and he should be able to handle a greater number of jobs. The system has proved quite successful in some plants, but has not been found practical at The Baldwin Locomotive Works.

A matter which concerns the paymaster's department is of interest in connection with the drawing rooms. The men are paid weekly on hourly rates, the detailers receiving from fifteen to forty cents per hour for a week of 46½ hours. All time work over 46½ hours is paid as time and quarter time. The men are permitted three minutes' grace in the mornings and at noon; if this is exceeded, a quarter hour is deducted. The time is kept by drawing-room clerks, who make the circuit of the rooms each evening and receive each man's statement of his time and the classification of the engine upon which he has been working. One week's time is held back, thus enabling the pay department to handle the work in the only logical manner.

The paymaster is announced as he approaches each room and the men arrange themselves in alphabetical order. Each man calls his name as he approaches the paymaster, and in this manner the men are served in a surprisingly short period.

It might be said, in conclusion, that any system governing such a plant as The Baldwin Locomotive Works is subject to progressive revision at all times, and although the fundamentals remain unaltered, minor changes are introduced from time to time.

"UNDERGROUND CONSTRUCTION."

Richard B. Ferris, E. E., 1917.

The increased use of electric current necessitating heavier lines and more unsightly poles, brought into use, in 1886, the underground system. At first, underground distribution was not a

great success, but it had the advantages of being more permanent in construction, less liable to injury from storms, and having lower maintenance and depreciation charges, and the appearance of the streets was greatly improved by the removal of the overhead lines.

One of the first systems to be adopted commercially was the Edison. It remained the standard for low tension distribution for about fifteen years. It consisted of twenty foot lengths of pipe, inside of which were copper rods imbedded in an insulating compound. The rods were wound with jute to keep them from sagging together. Hard rubber plugs in the ends of the tube spread the rods, and kept the compound from running out when it became warm. These tubes were laid in the ground, and the copper rods were joined together by soldered lugs, connected by a short piece of flexible cable. The joint was covered with an iron box, the halves of which were bolted together, and filled with hot compound. At intersections of the tube junction boxes were placed, containing clips and feeder connections for tapping off from mains. (See Fig. 1.)

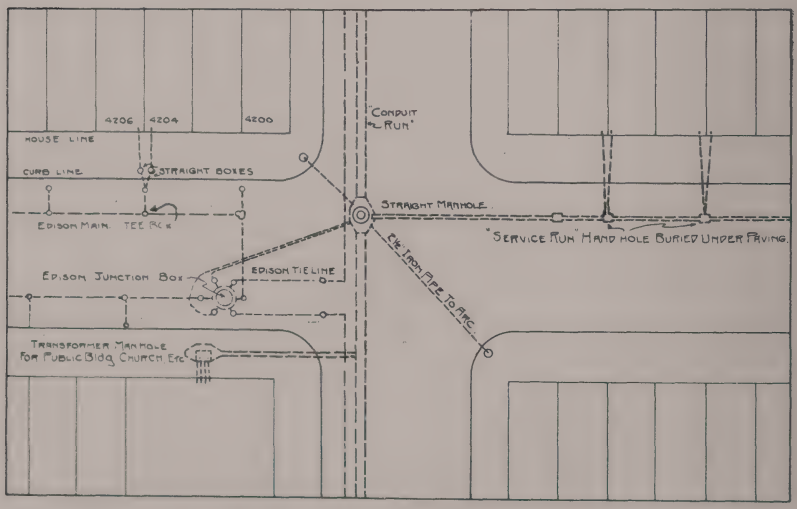


DIAGRAM OF A STREET INTERSECTION SHOWING CONDUITS.

Fig. 1

The ever-increasing loads on it, however, heated the conductors, melting and expanding the compound, which leaked out,

causing burnouts. About 1887 this system was replaced by cables drawn in conduit. The first conduit used was called troughing. It was made of creosoted planks nailed together. The joints and service connections were the old Edison "junction" and "tee" boxes. The troughing was not found to be lasting enough, and was replaced by a cast iron multiple trough. Two or three cables were tried in single troughs, but when the cables were withdrawn the lead sheathing was ripped off, and the cable ruined. Though this conduit was lasting, it was expensive, and was discarded for wrought iron pipe imbedded in concrete. This made a good conduit. Where the iron pipe rusted away a concrete duct was left. The corrosion of the cable cover caused by the moisture in the conduit was the drawback of wrought iron pipe, and to correct this tin pipe was used, which was enameled inside with a coating of neat cement. A quantity of this conduit was laid in Philadelphia by the Rapid Transit Company and is still in use.

Pump log conduit made of soft creosoted wood milled to proper dimensions came next. The first was called Valentine's duct, made of planks milled with semi-circular grooves, which, when built up, formed the ducts. Another form was of square timbers, drilled, the ends having ball and socket joints. About the time these became popular, the streets, especially those in business districts, had become crowded with conduits of all kinds, and water and gas mains. Pump log ducts were good for straight runs, but were not flexible enough to lay around these obstructions, and could not be changed once they were laid. They were also fairly expensive. They rendered little protection to the cables, were not mud proof, and had to be cleaned before new cables could be drawn in. When the wood became soft, the rods, striking an obstruction, would deflect upwards into another duct, and damage the cable in it. To overcome this, multiple and single conduit was made of vitrified clay. The standard lengths for it were 18" for camp or single duct, and 36" for multiple.

The multiple duct first had round boxes, but the cable was found to pull easier through a square hole; so square conduit was made, and is used today. It is made with 2, 3, 4, 6 and 9 ducts, the "fourway" being the cheapest and easiest to handle. It is laid on a bed of concrete three inches thick, and the ends are held in line by two or more dowel pins. The joints were

wrapped with a perforated metal band and cemented over. The sides and top are covered with creosoted boards for protection. Camp duct comes in three sizes, 3½", 4¼", and 6" round bore. They are hexagonal; the sides grooved, making more surface for the cement to grip. They are laid on a 3" bed of concrete covered with about ¼" of cement. They are put down in layers, staggered that no two joints are together. Each layer is covered with cement and the sides and top protected by 3" of concrete. A mandrel with a brush is pulled through while the conduit is laid, cleaning the cement from the inside of the joints. This construction, when it hardens, makes the strongest conduit known. It will not break down over large cave-ins. The vitrified clay when properly prepared and glazed lasts indefinitely. It possesses high insulating qualities, and great mechanical and dielectric strength. It shows an average puncture test of 21,000 volts between inside and outside walls when wet. As it is now made, it costs less per duct per foot than any other conduit, when laid. Though small particles of grit and stone sometimes become baked into the inside of it, damage to the cable sheath will be prevented by properly greasing it before it is pulled in. Camp duct may be run in any curve, and lends itself easily to changes in construction.

Another form of conduit now used, made with the idea of reducing the cost of underground construction, is the bituminized duct. It is composed of rolled tubes of wood fibre, or paper impregnated with a bituminous compound containing creosote. The creosote destroys the bacteria in the wood fibre which cause mould and rot. The fibre duct is laid in a trough, a layer at a time. The conduits are separated by wooden spreaders. Fine concrete or grout is poured over it. When it has hardened the spreaders are removed, and a new layer put on. The joints are made water-proof by dipping them in heavy asphaultum paint. Any cement which might leak through is brushed out before it has had time to harden. Where the spreaders cannot be withdrawn asbestos strips are put in and left in. The duct itself is inflammable, but there is no danger of the fire spreading from one conduit to another. When the duct is rodded there is a tendency in the fibres to "pile up" in front of the rod, so blunt end-pieces must be used on them. When this conduit is heated or soaked in water it bends easily, so that short pieces and bends need not

be used. It is light, reducing freight charges, and cost in handling. Care must be taken, however, in laying it, as it is extremely fragile. Its light weight makes it admirable for construction over bridges.

Very often, where there is little danger of damage to the cable, it is laid without conduit. The Philadelphia Electric Company has a plough used to run cable in parks and across lawns. The cable is hooked in back of a torpedo-shaped bar on the point of the plough-share, and the cable plowed under, doing away with the expense and time of ditches, and without spoiling the appearance of the lawn.

At street intersections where it is necessary to tie the cables together to feed both ways, or at distances of about 500 feet in the conduit, manholes are built; and the ducts are rodded and cables pulled through these. The manholes are shaped so that the cable may be bent around the walls, the angle of the walls depending on the size of the cable. Some are used to contain transformers.

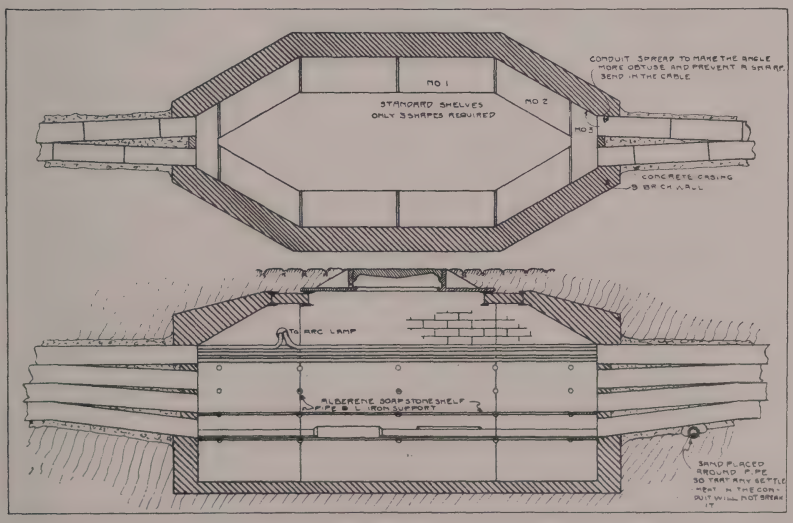

CONDUIT SPREAD TO MAKE THE ANGLE MORE OBTUSE AND PREVENT A SHARP BEND IN THE CABLE
NO 1
NO 2
NO 3
STANDARD SHELVES ONLY 3 SHAPES REQUIRED
CONCRETE CASING
BRICK WALL
TO ARC LAMP
ALBERENE SOAPSTONE SHELF
PIPE & L IRON SUPPORT
SAND PLACED AROUND PIPE SO THAT ANY SETTLEMENT IN THE CONCRETE WILL NOT BREAK IT

Fig. 2

The standard manhole is built of soft brick, and is hexagonal in shape. (See Fig. 2.) Rows of short lengths of iron pipe are built into the walls. Two pieces of angle iron are put into each

pipe (where the shelves are to be used) and a soapstone shelf placed between the angle irons, resting on the flanges. The conduit ends running into the manhole are spread apart sufficiently to allow room for a splice. The cables are wrapped with asbestos cloth.

In a long cable line each cable is placed as nearly as possible on the corresponding shelf in each manhole. In order that the rods may be pushed through the duct easily, the floor of the manhole is built at least twelve inches below the lowest duct.

Manholes were once built with a connection to a sewer in each for drainage. On account of explosions of sewer gas, and complaints of gas coming in through the house services, this was done away with. When the manholes are built now, the flooring of brick is laid loosely on a bed of sand or gravel. Where some other drain is necessary, a hole is dug in the bottom and filled with about a cubic yard of broken stone and the bricks laid on that.

Alberene soapstone is most used for shelves. It is cut to standard size, and the straight manholes, corner manholes and offsets are designed to accommodate the stone.

The heavier cables are run through the larger duct, which are usually placed on the bottom. Arc cables, pressure wires and light telephone cables are in the upper, and are racked around the sides in grooved terra cotta slabs, which are built into the wall as bricks.

Where the manhole is shallow and there is not enough room to draw the sides over together to hold the cover, the top is covered by a slab of slate or "I" beams with a course of brick between.

Conduit should always drain toward the manholes, and ducts not in use be plugged in some way to keep them clean, and free from gas.

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of

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EDITORIAL.

The Journal

The Towne Scientific Journal is at last a fact—the realization of a practical dream. The progress of its forerunner, The Whitney Magazine, was an excellent one. Having started in a meagre fashion it grew with alacrity until it reached a position of prominence among collegiate publications of higher calibre and rating. The growth, however, had attained its maximum peak—its saturation point, and to continue meant a horizontal rather than disingenous line of advancement.

It was with these facts in mind that interest and co-operation

among the Architectural Civil Engineering and Chemical Departments was awakened and enthusiasm aroused. We now have, it is hoped, a publication symbolic of the activities of the undergraduates, alumni and faculty of the entire Towne Scientific School.

Policy

With the initial issue of the Journal there arises inquiries regarding the policies and plans of the publication. The Journal is the organ of the undergraduates; supported and managed by them, yet supervised and aided by both Faculty and Alumni.

Consistency and conservation must be its keynotes; its management efficient and expeditious and its purpose of the highest calibre.

Appreciation

The Editor wishes to express his great appreciation to the Faculty for their assistance and advice in making possible this merger; to Messrs. Brumbaugh, Tusler and Hillman; and to the Departmental Societies for their hearty co-operation.

Business Organization and Operation

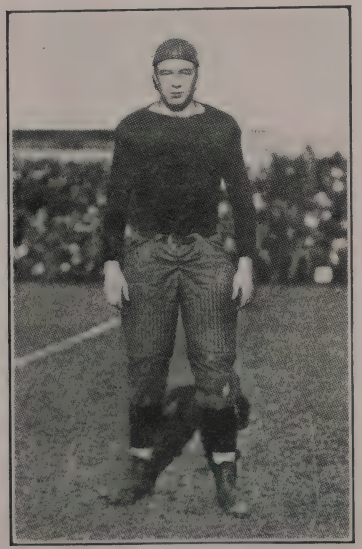
Too little attention is paid by technical and architectural students, to the actual business or financial side of their respective professions. True enough, that courses in business law and economics are pursued, but these go only part way in their purpose.

How many have even a superficial knowledge of the organization, operation or financing of a corporation? How many are acquainted with the functions of a board of directors or with the powers of a chairman of such? What students are familiar with such terms as charter, debenture, bonded debt, preferred stock, etc., or with the methods of financing large operations?

A systematic study of the fundamentals underlying all business enterprises; the interdepartment relation of concerns and the legal elements affiliated with such are as essential to a successful man as mere knowledge of theories and principles, for, after all, engineering and capital are dependent one upon the other.

LOUIS ALONZA YOUNG
C. E. '14
Varsity Captain, 1913-1914

E. J. REILY



SIMPSON
M. E. '14

CROSS
C. E. '14

HILL
C. E. '14

E. J. REILY

Get Acquainted

There is too great a tendency among many men in The Towne Scientific School to keep within themselves or within their own particular set. No profession requires more co-operation, more friendly criticism or more broad-mindedness than do those of architecture and engineering, and an early acquisition of such is inestimable.

Come out of your shells, mix with all types. Mingle with the garrulous, the affable, the reticent and the recluse. They all have their value, their particular size-up of matters and even the self-centered man can teach you something. Get into things and you will find that the "more you do, the more you can do" is pretty solid truth.

The Honor System

The interest of the Towne Scientific School is very centered at present upon the development of the Architectural Honor System. Its probable adoption by all of the departments of the Towne Scientific School will depend upon its success or failure this year. The success of the system will be to a great extent determined by the men themselves, but to a greater extent by the men on the Honor Committee.

Upon the punishments they impose, the justice of the punishments, will depend the effectiveness of the system.

To perfect the idea as was originally intended by the promoters it is necessary that the guilty men shall be looked down upon, made to feel the shame and disgrace they have brought upon themselves.

The suspension of a man for two weeks, or dropping him from the course in which he was caught cribbing, in no way disgraces him, unless the whole student body knows of his suspension, or expulsion, as the case may be. A two weeks' vacation is not a punishment, the addition of a public announcement that one's word of honor is not to be relied upon would disgrace and shame any man.

In all universities there seems to be a feeling of "Laissez faire" among the undergraduates when it comes to taking a part in the affairs of the college world.

Leadership

The question of leadership is discussed by nearly all of the men who make up the student body. The criticising, oftentimes just, of the men acting as leaders, the heads of the various activities, is not to be discouraged. The statements that the men acting as leaders are not the best men, not the typical students, cannot in a great many cases be denied. They can only be attributed to one thing, a lack of initiative on the part of a great majority of the students.

What the university needs, what the world needs today, is not brilliantly-developed men along one line, but well-balanced, well-read men of symmetry; not brainy theorists, but men of practicability, with force and strength which will enable them to put through their projects; men who stand out and lead in the world's work, who meet life's obstacles with persistence, courage and cheerfulness; men with unlimited capacity, and unbending will for the work constantly before them. Such men are bound to stand head and shoulders above those about them, to be leaders.

Department Societies

There are a number who do not show sufficient interest in the Societies of their respective departments. This is a condition which should be speedily rectified. Such men seem to be content with a daily campaign of obtaining marks. This is an entirely wrong attitude.

The purpose of these societies is threefold. First,—to bring into closer relationship the members of each department; second,—to acquaint their members with the important features and problems of their respective professions; third,—to train their members in the art of reasoning logically and talking fluently before large audiences. How many feel at ease when on their feet before a sea of faces?

The Undergraduate Assembly Room

The University has refurnished in a splendid manner, at a considerable expenditure, the undergraduate assembly room in the Engineering Building. It is, therefore, essential on our part, that we show our appreciation of its generosity by using it whenever possible and properly deporting

ourselves while there. Observe the little frame of regulations with a spirit which is indicative of our estimation of its consideration.

Cover Design Contest

We take pleasure in announcing Mr. Frank M. Holcomb, Arch. '14, as the successful competitor in the Cover Design Contest.

New Lecture Course

The course in lectures, by prominent engineers, is already under way and promises to be one of the most interesting and broadening features of the junior and senior curriculum. It is through such mediums as these that the student becomes better acquainted with the "outside" and acquires a clearer understanding of the practical conditions which must be met upon graduation.

The Publication Building

The surplus from University periodicals is to be used in the erection of a separate building upon the campus for the housing of all these publications. Pennsylvania will be unique in this respect and it behooves all of us to aid in the speedy realization of this distinctive movement.

The Faculty Committee on the Journal consists of the following:

Prof. J. J. Morris, Chairman; Profs. W. E. S. Temple, E. T. Grandlienard, H. S. Lukens and Mr. Goodwin.

ALUMNI

1876—William Goodwill Button. Has the position of structural engineer, Bureau of Building Inspection, Philadelphia.

1876—Henry Harrison Supplee. Has been elected president of the Cassier Magazine Company of New York.

1877—Horace Wells Sellers. Is an architect and consulting engineer in Philadelphia.

1881—George Chapman Thayer. Has been elected president of the Kensington Shipyard Company, Philadelphia.

1884—Charles Ellis Ellicott. Is president of the Ellicott Machine Company, designers and builders of hydraulic dredges, Baltimore, Md.

1886—Joseph David Israel. District manager The Philadelphia Electric Company, Philadelphia.

1886—David Edward Tracy. Has been appointed general superintendent of the Harrisburg Pipe and Pipe Bending Company, Pennsylvania.

1890—Adolph William Schramm. Has been elected president of the Electro Dental Manufacturing Company in Riverton, N. J.

1892—Herbert Eugene White. Is now chief engineer of the General Fireproofing Company, Youngstown, Ohio.

1893—Howard Adler Loeb. Was appointed vice president of the Tradesmen National Bank, Philadelphia.

1893—Tausen Haines. Is now president The Des Moines Gas Company, Iowa.

1893—John Eyre Morgan. Has been appointed manager of the Conewago Gas Company, Hanover, Pa.

1895—Mathias Harry Holtz. Has the position of chief inspector of the Electrical Bureau of the City of Philadelphia.

1895—Albert Pancoast. Is vice president and general manager of the Union Spring and Manufacturing Company, Oakmont, Pa.

1897—Durbin Heister Bradley, Jr. Is engineer and manager of the Parral Consolidated Mines Company, Chihuahua, Mex.

1898—George Lewis Mayer. Has been appointed secretary and treasurer of the Stitzer Engineering and Contracting Company of Philadelphia.

1899—William H. C. Ramsey. Is superintendent of the Johnstown Water Company, Pa.

1900—Stewart M. Marshall. Was appointed chief engineer of the Cambria Steel Company, Johnstown, Pa.

1901—William Cauly Janney. Is assistant superintendent of the Syracuse Lighting Company, N. Y.

1902—Ramon M. Picado. Is city engineer of Cartago, Costa Rica.

1904—Frederick Andrew Bokop. Is manager of the Defiance Welding Company, Ohio.

1906—Thomas Ernest Rodman. Is sales agent of the Brunker, Brown Company of Philadelphia.

1907—Kyoichi Izumi. Is connected with the Isihihawajima Shipbuilding and Engineering Company of Tokio, Japan.

ARCHITECTS.

1910—Grant Simon. Won the Paris prize last year.

1912—L. Shay. Won second place in the Rome prize competition.

1911—William Hough. Of the '10-'11 track team, procured a mention in the Paris prize.

1907—Woor C. Stanton. '06 and '07 track team, has recently won the position of secretary of Comprehensive Plans Committee of the City of Philadelphia.

At the University Council held on December 12, degrees, as of their respective classes, were conferred upon the following three former students in the Department of Civil Engineering:

Cresson, Benj. Franklin—B. S., of the class of 1894. Mr. Cresson was connected for many years with the construction of subaqueous tunnels entering New York City. He then became First Deputy Commissioner of the Department of Docks and Ferries, New York City, and he has recently been appointed engineer to the New Jersey Harbor Commission, Jersey City, N. J.

Crawford, Joseph Emanuel—B. S. in C. E., as of the class of 1897. Mr. Crawford received his earlier experience in engineering practice in the office of the Pencoyd Bridge Company, afterwards becoming in turn inspector of bridges and engineer of bridges of the Norfolk and Western Railroad. He has recently been promoted to the position of acting chief engineer of that road.

Conway, John A.—B. S. in C. E., as of the class of 1900. After a varied experience of four or five years in engineering lines, Mr. Conway, in 1905, became connected with the U. S. Reclamation Service, in which he advanced by successive promotion to the rank of project engineer. He resigned from that service about three years ago to enter

the U. S. Lighthouse Service, in which he was first chief construction engineer, and now is deputy commissioner of lighthouses.

1905—Jonathan Jones. Mr. Jones has resigned his position as engineer of the McClintic Marshall Construction Company, Pottstown, Pa., to accept the appointment of assistant engineer in the Bureau of Surveys, City of Philadelphia, in responsible charge of the design and construction of bridges. In the Civil Service Examination to fill this position, Mr. Jones obtained the highest rank.

1906—A. T. Goldbeck. Mr. Goldbeck recently resigned his position as engineer of tests of the U. S. Office of Public Roads, Washington, D. C., to become engineer of tests, Bureau of Surveys, City of Philadelphia.

1893—E. P. Witmer. Mr. Witmer has severed his long connection with the American Bridge Company, in whose employ he had risen to the rank of engineer in charge of bridge design, to become structural engineer of the Brooklyn Transit Company, Brooklyn, N. Y.

1897—Richard W. Tull. Mr. Tull has recently been promoted from assistant contracting engineer to contracting manager, Eastern Steel Company, 60 Broadway, New York.

1898—J. P. J. Williams. Mr. Williams, formerly assistant professor of civil engineering at Columbia University, New York City, has accepted an appointment as assistant professor of structural engineering at the University of Minnesota, Minneapolis, Minn.

1906—J. F. S. Donnelly. Mr. Donnelly is chief draftsman of the Cuba Railroad Company, and is in full charge of extensive construction work on that road, including buildings, culverts, bridges and track work. He is stationed at Camaguey, Cuba.

DEPARTMENT NEWS

The first of a series of monthly lectures to be given to the Junior and Senior Classes of the Engineering Schools was delivered on October 14 by Mr. Alfred D. Flinn, department en-

gineer of the Board of Water Supply of New York City. His subject was "The Engineering Activities of New York City" and in it he described the important engineering works, such as the Catskill aqueduct, the new railroad terminals, the Hudson tunnels and the East River bridges. He also gave figures showing the growth of the city in population and commerce, and the probable development in the future. The lecture was illustrated by lantern slides.

THE WHITNEY SMOKER.

The annual smoker of the Whitney Engineering Society was held Friday evening, October 24. This was the first affair where this year's freshmen of the mechanical, electrical and chemical engineering departments of Pennsylvania had a chance to meet their upper classmen in a social way, and at the same time see on what an elaborate scale such events are conducted in the engineering building.

An extensive program had been arranged. After Yungman, president of the Whitney Engineering Society, had made a short address he introduced Mr. Rindge. Mr. Rindge enjoys the reputation of knowing more engineering students than any other man in the country. He told us of a special work of engineering students in other parts of the country, how they were going into machine shops and teaching the men the simple fundamental engineering principles of which they had hitherto been totally ignorant, and which they were anxious to learn. Under his direction such a movement has been started here, and already some of the seniors are holding classes in the evening and instructing shop hands in the theory of the work they are doing every day, and in turn are being benefited by contact with the class of men which later they will be called upon to direct.

Next, Mr. Blackledge, 1914's great prestidigitator, entertained us with his legerdemain tricks. Several people who had seen Mr. Blackledge perform before got together during the performance and decided to concentrate their attention on the instantaneous transfer of the American flag from one side of the room to the other. The trick over, every one was just as completely mystified as he was upon witnessing it for the first time.

But how can we hope to find the secret when even Blackledge, himself, says: "I don't see how I do the things I do."

Professor W. E. S. Temple then outlined the great strides taken by the Electrical Engineering Department and mentioned its rapidly growing enrollment as an omen of what is to be in the future.

His reminiscences upon the early smokers and the conditions under which engineering was taught in the old building were thoroughly enjoyed by everyone.

Mr. R. H. Wright next held the entire room spellbound while he went through a series of remarkable impersonations. He did all his making up right on the stage, in full view of the audience, and at the same time telling a story leading up to the scene he was about to portray. If the professional vaudeville stage presented such numbers we would not consider our time spent in seeing them wasted as we so often do now.

The engineer orchestra rendered several selections. Considering the short time they had to practice for the performance they did well; had they had a few more rehearsals they might have done *very* well.

Dr. Smith was the last speaker. He read part of an address he delivered many years ago to a graduating class of Pennsylvania. It contained much of early history of the University about which most of us are totally ignorant, but about which we all should be familiar. Dr. Smith said that he received a letter from Dr. Furness, shortly before his death, in which he spoke of this address and suggested that he read it before the students of the University at least once a year. Nothing could be more appropriate, and Dr. Smith need not feel that the students require an apology from him every time he mentions the valiant exploits of our older brothers.

Heretofore the Whitney Engineering Society has always been noted throughout the college for its unfailing attention to the needs of the inner man. The refreshments provided at the smoker proved that this year was not to be an exception to the general rule. A number of our new friends who were having their first big party rather outdid themselves and consequently the many helping had their ill effects. Most of the young boys behaved themselves quite well, though, and we hope to see them attending all of the regular meetings throughout the winter.

FRESHMAN RECEPTION.

On Friday evening, October 10, the freshmen of the Civil Engineering Department were tendered a reception by the Civil Engineering Society in the Engineering Building. President Hillman acted as master of ceremonies. The speakers of the evening included Provost Smith, Dean Frazer and Professors Fernald, Marburg and Ingram, of the Engineering School Faculty. Special emphasis was laid upon the proper attitude of the student toward his college work and toward college activities. The quartet was there, too, and pleased the appreciative gathering with a number of well-rendered selections.

At the conclusion of the meeting ice cream and cake were served a la "Old Time," and an opportunity afforded the freshmen of meeting the upper classmen.

C. E. SOCIETY.

The Civil Engineering Society held its first monthly meeting Friday evening, November 7, in the Engineering Building. The speaker of the evening was A. E. Mellon, '14. The subject was "The Construction of a Reinforced Concrete Highway Bridge over the Hillsboro River at Tampa, Florida," and was illustrated with numerous lantern slides. The evening concluded with an informal social gathering and refreshments.

THE PRIESTLEY CLUB.

The first meeting of the year was a short one, held Monday, October 6, to transact a small amount of business. Thursday evening, November 6, was the annual fall amateur night. Talks on their last summer jobs were made by Deacon, '14; Foulds, '14, and Brown, '14. A double quartet rendered several selections; Barrett, '14, and MacDonough, '14, boxed a three-round draw, and the usual eats and smokes were on hand. Spring, '14, was chairman of the committee in charge of this meeting.

Class football teams have been organized, and a schedule of games arranged. Two games have already been played, the

Seniors having tied the Sophomores 6-6 and defeated the Juniors 12-7. The remaining four games will all be played before Christmas.

Work on the annual Christmas play and smoker (to be held Friday night, December 12) is well under way and every indication points to a record attendance. The name of this year's production is to be "La Belle Pipette" and the committee promises the spiciest show seen in several seasons. Spooner is in charge of the play committee, Anderson is to see that the stage is put up properly, Kirchner is managing the printing and advertising end, and Goodpasture has a committee at work on the eats and smokes. Clark is chairman of a general committee composed of the men just mentioned. Several prominent alumni and members of the faculty have accepted invitations to attend, and of course all the undergraduates are coming.

ARCHITECTURE

The opening exercises of the Department of Architecture, in celebration of its twenty-fourth anniversary, were held on Friday afternoon, October 17, in the large lecture room of Engineering Hall.

The meeting would have enthused all loyal sons of Pennsylvania; nearly every man of the 256 in the department was there and filled with the spirit that has made and will continue to make Pennsylvania the leading school of architecture. Pennsylvania spirit has been, is, will be, the subject of discussion for years to come. The architects have Pennsylvania spirit; fostered under the most adverse conditions, guarded by men, not of Pennsylvania, it is true, but loyal Pennsylvanians nevertheless, who are growing examples of what can be accomplished by unbounded love and devotion on the part of the faculty.

Dr. Laird has called to the University, specialists in every branch of architecture, men of recognized ability and authority; men who, since coming to Pennsylvania, have left nothing undone for the betterment, development and improvement of one of the best departments in the University; men who are pleased

when called upon to help; who mingle with the students on their work, and who criticise with almost a superhuman knowledge of each individual.

It is due to the untiring efforts of Dr. Laird and his enthusiastic colleagues that there has sprung up in the midst of the University group a department that has come to be recognized as the best and largest architectural school in America.

The growth of the department has been phenomenal, as is shown by the accompanying diagram. The library on the third floor of College Hall, which originally housed the department, was soon overcrowded and in 1910 it was found that the third floor would not contain the rapid increase, and the chapel was then made into a drafting room. Today the freshmen are temporarily housed in the Engineering Building, and when they start design they are going to miss the assistance of the upper classmen, which has done much in the past towards helping the new men in starting.

The overcrowding has come to be a serious matter. The drafting rooms are filled to the limit, they are poorly ventilated and badly lighted; the lecture rooms are so small that some of the professors have to repeat their lectures several times. The studio is small, cold and inconveniently located.

In the fact of all of these obstacles the students have continued to turn out exceptional work in design, winning the prizes that placed Pennsylvania still higher among the best colleges.

Looking into the future it is hard to imagine the Architectural Department in any other position than in the lead. The men who in the past have placed Pennsylvania in her position of prominence in the architectural world were clever, industrious and untiring in their efforts, not "social dissipators," but loyal, dependable and conscientious Pennsylvanians. They have set a high standard of work, and it becomes the duty of every man to help keep the Pennsylvania colors in the foremost rank of American Architectural Colleges.

THE

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CONTENTS

March, 1914

WARREN P. LAIRD, Sc. D . . . . . Frontispiece

FOREWORD 49

AN APPRECIATION OF WARDWELL TOWNELEY . . . 50
Warren P. Laird, Sc. D

ARCHITECTS AS WINNERS 51
W. G. Mann, Arch. '14

"MONUMENT AT GETTYSBURG," 52
K. C. Welch, '16

GRADE CROSSING ABOLISHMENT IN CITIES 56
Samuel T. Wagner. C. E. '81

ALTERNATING CURRENT TRACTION 62
Albert P. Godsho, E. E. '14

"A MOVING PICTURE THEATRE," (Plan) 72
Walt. Antrim, Arch. '15

THE INVENTION AND DEVELOPMENT OF THE SLIDE RULE . . 73
G. H. Eckhardt, Ch. E. '14

"A MOVING PICTURE THEATRE," (Elevation) 76
Walt. Antrim, Arch. '15

PROPOSED METHOD FOR LIGHT SEASHORE BUILDING CONSTRUCTION 77
Malcom Duncan, C. E. '15

SALT AND THE ELECTRIC CURRENT 79
F. Sidney Deacon, Ch '14

"THE CENTRAL HALL OF A LARGE MINERAL WATER ESTABLISHMENT" 80
E. A. Self, Sp. '14

EDITORIAL 82

ALUMNI NOTES 87

DEPARTMENT NEWS 91

THE ARCHITECTURAL PLAY 93

PICTURES OF "BLUE SMOCK" 94

ADVERTISEMENTS

Warren P. Laird, Sc. D.

Towne Scientific School Journal

Vol. I MARCH, 1914 No. 2

FOREWORD

The engineer and the architect have so much in common in the professional field that it is easy to discover a community of interest between them during the period of University training. This is fostered by the "Towne Scientific School Journal," to which, in this note, it is a pleasure to wish a useful and prosperous career.

While architecture is in sum a Fine Art, yet construction is so essential to its technique that the architect must always to a degree be engineer as well as artist. And with growing frequency he enlists the service of his more scientific colleague in complex structural and mechanical problems. Conversely, the architect has in his own special function contributed to the success of great engineering works, and the value of this co-operation is being more and more recognized.

It is well, therefore, that each group become acquainted with the aims and ideals of the other, and there is no better time and place to begin this than "college days" and the pages of the "Journal."

WARREN P. LAIRD.

February 14, 1914.

AN APPRECIATION OF WARDWELL TOWNELEY

It was the writer's privilege to know "Ward" Towneley both as pupil and friend, and thus to have gained some insight into a character of exceptional attractiveness. From the time of his admission as a student in architecture he gave evidence of superior qualities, both of mind and heart, and won his way into that esteem and affection, of fellows and teachers alike, which always attaches to modesty and worth.

A more than ordinary success seemed assured to his future professional career. Well endowed mentally and with a sturdy capacity, for serious work, he soon showed unquestionable talent for architecture and made highly gratifying progress. Two marked traits of his nature were idealism and sensibility to beauty; qualities priceless to the artist and full of promise of fine professional achievement when combined with other endowments of mind and character so marked in Towneley.

Sadly enough, these very traits carried with them a sensitiveness to imperfection which, observed only shortly before his death, seemed to grow rapidly acute. Thus the passing faults quite usual to student work seemed to him to be critical, while the failure to achieve exceptional merit implied a serious deficiency. This condition, in direct contradiction of his generally high class standing, must have developed finally into a haunting fear of permanent failure.

This state of apprehension, in reality a grievous illness, must have been to him a real and bitter sorrow, and the fact that it was borne in silence now comes to his friends as a final and eloquent evidence of the essentially noble character of the boy, whom to know was to love.

WARREN P. LAIRD.

February 14, 1914.

ARCHITECTS AS WINNERS

W. G. Mann, Arch., '14.

Departmental pride is, or should be, a "hobby" for every man in the University. He should "boost" his department, not only in the inter-department arguments about his table, in his conversation with his "outside of the University friends," but more especially when talking to a man about to enter college.

Every man, no matter what his department, believes that he has the best course, in his particular line, to be found; but to convince his friends that Pennsylvania offers him the best in the country, is another matter. He must produce the facts.

All Architectural students are "boosters" at heart. They know that we have the best architectural school in America, but there are few of the students who can tell just how many and what prizes Pennsylvania men have won and why they have won them. They lack the facts.

This article is written in an attempt to give the facts, clearly, to all members of the Towne Scientific School; to make an "Architectural Booster" of not only every Architect, but of every man under Dean Frazer, whether he be a chemist, or electrical, mechanical, civil or chemical engineer; in other words, to secure new men for Pennsylvania.

There are three big competitions open to Pennsylvania men: The Rome Prize, offered by the American Academy in Rome, consisting of three years of study in the American Academy in Rome; the Paris Prize, given by the Society of Beaux-Arts Architects in New York, of two and a half years at the Ecole des Beaux Arts abroad, and the John Stewardson Memorial Scholarship of one year abroad.

The Rome Prize, perhaps the most to be desired of all the prizes, was won in 1911 by a Pennsylvania man, G. S. Koyl, and in 1913 W. J. Hough and H. L. Shay received the only Honorable Mentions awarded.

The Paris Prize is perhaps even more contested for than the Rome Prize because it is open to a greater number of students. Even with the great number of entries, Pennsylvania men for the past three years have been finishing their Architectural education abroad thru the kindness of the American Society of Beaux-Arts Architects. "Duke" D. Ellington winning in 1911,

"A MONUMENT AT GETTYSBURG"
FIRST MENTION, SIXTH GRADE DESIGN, K. C. WELCH, '16
(Courtesy Alumni Register)

Donald M. Kirkpatrick in 1912 and Grant M. Simon in 1913, have kept Pennsylvania well represented in the schools abroad. The chances for this year in the Paris Prize could not look better. The Society recognizes the ability of some of the contestants, judging from previous work handed in, and does not require them to take the first preliminary sketches. Pennsylvania had eight men exempted this year, and the judgment of the first preliminary is given below:

Author, award, atelier and city:

Baker, E. B.—Placed first, Third Medal; Philadelphia Atelier (student in Pennsylvania), Philadelphia.

Thompson, J. A.—Placed second, Third Medal; University of Pennsylvania, Philadelphia.

Hunt, D. M.—Placed third, Third Medal; University of Pennsylvania, Philadelphia.

Walker, R. T.—Placed fourth; Massachusetts Institute of Technology, Boston.

Wiehe, E. R.—Placed fifth, Third Medal; Atelier Brown Bourgeois, S. F. A. C., San Francisco.

Braunstein, R.—First alternate, Third Medal; Columbia University, New York.

Chillman, J. H.—Second alternate, Third Medal; University of Pennsylvania, Philadelphia.

Thus Pennsylvania was the only school to retain more than one man, having kept four; thereby giving Pennsylvania twelve men to compete in the Second Preliminary; men who will bring glory to Pennsylvania.

The American Society of Beaux-Arts Architects, in addition to the Paris Prize, offers two smaller prizes, each of $50 for first place and $25 for second, known as the Warren Prize and the Pupin Prize; the Warren Prize, given by Messrs. Whitney and Lloyd Warren, for excellency in planning of a group of buildings; the Pupin Prize, given by Prof. M. F. Pupin, of Columbia, for the monumental treatment of some scientific appliance.

Both these prizes were won by Pennsylvania men last year, the Warren by C. W. Stedman and in the Pupin Prize W. P. Barney took the money.

The Stewardson Prize has in its seventeen years of existence been taken by Pennsylvania men thirteen times. In the University the Seniors look dubiously at one another and wonder which one of the class it is going to be this year.

There is one competition above all others which interests the whole of the Architectural department, and that is the Interscholastic Competition. Monday morning, at nine, on February 9, Room 200 was filled with the upper classmen waiting for a chance to commence work on a competition which for the past two years has brought to Pennsylvania undisputed supremacy as an Architectural College. The Interscholastic Competition is open to members of the Interscholastic Architectural Federation, and such schools as they may invite to enter.

The Interscholastic Architectural Federation is made up of the following schools: Columbia, Cornell, Massachusetts Institute of Technology, Harvard and Pennsylvania. This year they have invited Syracuse, McGill and Carnegie Institute of Technology to join in the competition, which promises to be one of the most interesting so far held.

In the competition last year Pennsylvania took the prize in both Class I and II, W. J. Hough winning the Prize in Class I and W. B. Rabenold taking the Prize in Class II. In addition in Class I Pennsylvania took second and third mentions, as well as two other mentions. In Class II K. C. Welch took first mention, and Pennsylvania men took in addition a third mention and one other mention. The year before, competition of 1912, there were ninety-one drawings submitted, and from the nineteen awards the Architects from Pennsylvania took twelve, leaving Cornell five and Harvard two. The Interscholastic is of great interest to all the Architects, and perhaps this will help to explain the late hours during the first two weeks of March. Watch the results.

The Rome, Paris, Stewardson, Warren, Pupin and Interscholastic Competitions come but once a year, and though they are looked forward to, the Architects do not have a great deal of time to dream about them, for throughout the school year the American Society of Beaux-Arts Architects in New York submits at regular intervals problems under the headings of Class A Projects, Class B Projects, and Archaeology Projects. Pennsylvania men from time to time take the Class A Projects and the Archaeology Projects.

To give a complete list of all of the winnings in these com-

petitions would require a great deal of time and space, so I shall take the last Class A Project as an example. (We do not compete in the Class B, or lower-grade, Project.)

The problem called for the Interior Decoration of a Church, and there were fifty-seven drawings submitted for judgment from all parts of the United States.

In Class A the Society offers First Medals, Second Medals and Mentions. Pennsylvania received four of the six First Medals awarded, and seven of the twelve Second Medals. Every drawing which was sent up received either a medal or a mention, establishing, for Pennsylvania, a place as leader of all Architectural schools in America.

These facts will easily convince the most dubious man, of Pennsylvania's rank as an Architectural School. There is, however, another important consideration. How has Pennsylvania succeeded in taking so many prizes? Will she continue? There can be but one answer. The best design staff in the country will continue to attract the best men in America, and the combination is sure to win the prizes offered for the best architecture. There is one other factor which we must not overlook, and that is the spirit of the student body itself. I feel safe in saying that there is no other department in this or any other University in which the students work together as they do in our Architectural School. The criticisms of the upper classmen are sought by the men in the lower grades. They are not offended when told their work is poor, but remedy the defect for the next criticism. The upper classmen are ever willing to assist. It is a pleasure to all in the department to help.

Our design staff, working under these conditions, with the cleverest men in the country, must continue to carry off the prizes, which will in time place Pennsylvania as the foremost Architectural College in the world.

Just before going to press a cablegram reached us announcing the fact that "Duke" D. Ellington won the Rougevin Prize, the largest attended competition in the École des Beaux-Arts. This is the first time that it has ever been won by an American in the fifty-seven years it has been offered, establishing the truth of the above clause, that Pennsylvania will soon be ranked as the foremost Architectural College in the world.

GRADE CROSSING ABOLISHMENT IN CITIES

SAMUEL T. WAGNER, C. E., '81.

As a general principle no grade crossings should be allowed where rapidly-moving trains cross a highway or a line of railroad. All are dangerous. The lives of the public on a highway are endangered where such a crossing exists, and where two lines of railroad cross at grade, while the control of trains is better provided for by interlocking signals, the danger still exists, and in the case of an accident the loss of life and property is likely to be much greater than on a highway grade crossing. For this reason the railroads, without being required by law, are constantly endeavoring, as fast as their resources permit, to do away with such crossings even where it is possible for their own trains to come into collision, in spite of the fact that they are protected with the most modern provisions for safety.

It is, however, the case of the crossing of a railroad with a highway that is the special purpose of this discussion, and generally there are six different ways in which an existing grade crossing can be abolished:

1. Raising the highway over the railroad.
2. Lowering the highway under the railroad.
3. Lowering the highway and raising the railroad.
4. Raising the highway and lowering the railroad.
5. Raising the railroad over the highway.
6. Lowering the railroad under the highway.

By an examination of these methods, the changes required to the railroad are a minimum in Cases 1 and 2, and increase in the order given, while exactly the reverse holds good when the changes required for the highway are considered. It would also seem that, other considerations being equal, Cases 3 and 4 would affect the railroad and highway equally. In all of these cases it is evident that either the highway or the railroad has to increase its grades, and this single point is generally the most difficult one to decide upon in any particular case. The increase of grades on a railroad is almost always the loss of net revenue. On a highway it is difficult to calculate actual money loss. Light grades in such a case mean expensive first cost where the highway is built up with expensive properties facing on it which have

"BEFORE"

"AFTER"

CROSSING AT 19TH AND WESTMORELAND STREETS, PHILA., PA.

to be adjusted to the new conditions. The consequential damages which may be recovered by law for such changes are often a large item of the total cost of the work. It is evident that the only cases in which there are no consequential changes due to changes of grade of the highway are 5 and 6.

Many grade crossings have been caused by a city and railroad growing up together, both unable to spend much money, and the crossings being created without much thought for the future increase of travel on both. The increase of such traffic creates a condition which goes on from bad to worse until it finally becomes intolerable. Fortunately, such conditions can hardly be conceived of for the future, as the laws in almost all States are such as to prevent the creation of a grade crossing.

The problem to be met is, therefore, the elimination of existing crossings and the question of the division of the cost is one of the most difficult to arrange for. Unfortunately, such work is profitable to neither city or railroad; that is, neither can expect, except in a very small way, to receive any financial return for the large amounts of money which must be expended. The railroad will save a little in not having to maintain gatemen and the necessary upkeep of the crossing, and it will be easier to keep trespassers off the line. Further, accidents will be much less, but it has been the experience with many railroads that most of the grade-crossing accidents are such as to make it very difficult for those injured to recover money value in case of a lawsuit, as most of the accidents can be shown to be due to what is technically known as "contributory negligence;" that is, the person has not "stopped, looked or listened," as required by law, or has done something contributing to the accident. However, there is a moral obligation to get rid of such conditions that railroads are always ready to accept provided they have the necessary means.

The question of the proper division of cost between a railroad and a city is one that depends very much on local conditions, and no positive rules can be laid down. In some cases and in some States the cities have compelled the railroads to pay the entire cost of removing crossings on the ground of their being a public menace. In others, in cases where the crossings have been made by the city, or the city has allowed them to be made in the course of time, it has been the practice to divide the cost in some manner

between the two interests. Prominent cases will be shown later to indicate how this has actually been done.

From the standpoint of the engineer the general question is almost always separate from its financial features. It is a cold-blooded examination of determining the cheapest and best all-'round method of getting rid of the crossings, and what this may be has to be decided by the most careful studies of each case. The importance of the line of railroad, the prominence of the highways and the general topography are usually the dominating features, and it is possible that, in a series of crossings lying adjacent to each other, many of the six cases above referred to may be combined in a single piece of work.

In many ways the work of elevating the tracks of a railroad proves the most economical, although not always the preferable way from the standpoint of the city, on account of aesthetic features. Where a street grade has to be changed to any great extent it becomes necessary to change the sewers and other underground structures, and such work is very expensive. This may happen to the sewer systems where the railroad is depressed and the streets left in their original condition. As far as consequential damage to adjacent property is concerned, the cost of the erection of an elevated railroad is much less than the depression of the highways. If an elevated railroad can be built with masonry walls and a fill of earth between intersecting streets and with bridges of solid steel floors, properly waterproofed and carrying the track on ballast, or preferably with concrete arches, the first cost will be very much reduced and the cost of maintenance will be a minimum.

In the case of a depressed railroad with a highway above it, it has become recognized practice to build the bridge either of concrete or of steel encased in concrete so as to prevent the rapid corrosion of the metal from the locomotive fumes. This case also involves much expense in the necessary underpinning of buildings where the highways are left in their original positions and the railroad alone changed. This expensive work of underpinning has also to be done on highways where the grades are changed sufficiently to expose the foundations of the buildings. There is also an objection to having the railroad depressed to its full extent, in that the smoke nuisance is exaggerated.

In case the railroad has connections to industrial establishments, or has freight yards along its line, the cost of an elevated railroad is much less than if it were depressed and the inconvenience to adjacent property owners less expensive and annoying.

The consequential damages caused by raising a highway in a densely-populated section are very great and should be avoided wherever possible.

In many cases it is possible to elevate a railroad above a highway sufficiently to enable a steel structure to be constructed and a highway maintained beneath it. The additional cost of the steel structure over one of masonry and fill, and its increased cost of maintenance may be justified by the use which the city can make of such a highway. Modern construction makes it possible to build such a structure so that the elements of noise, dirt and vibration are negligible. This is accomplished by means of a solid floor of steel filled with concrete, waterproofed and carrying a standard railroad track with ballast.

The work of eliminating grade crossings has progressed rapidly in a large number of American cities in the past twenty years, Chicago, Brooklyn and Philadelphia being probably the chief centres.

In Pennsylvania, under an act of the Legislature, cities and towns may enter into contracts with the railroads for the relocation, reconstruction or elevation of their lines with a view of eliminating such crossings, and under this law a vast amount of work has been done in and around Philadelphia.

Along the New York Division of the Pennsylvania Railroad many crossings have been abolished. The railroad bore the cost of constructing the bridges or elevating its tracks where required, and the city the cost of making the changes on the highways, together with the consequential damages.

What was known as the Pennsylvania Avenue Subway on the Reading System was accomplished by depressing the tracks of the railroad in open cut and tunnel. The cost was equally divided between the city and the railroad. By it seventeen dangerous grade crossings, including the main entrance to Fairmount Park, were abolished, at a total cost of $5,487,000. The estimated cost was $6,000,000.

Thirty grade crossings were abolished on the Philadelphia

and Trenton Railroad (Pennsylvania System) in the northeastern part of the city by an elevated structure. The city paid $800,101 and the railroad $667,541.

Twenty-eight crossings of the most dangerous character have been recently abolished on the Philadelphia, Germantown and Norristown Railroad (Reading System) between Green street and Wayne Junction, in which the city and the railroad shared equally as far as replacing existing conditions was concerned. This was done by an elevated structure, which cost about $7,000,000. The estimated cost was about $7,600,000.

On the Richmond Branch of the Reading System two very dangerous crossings have been abolished and two new streets opened under the railroad, at a cost of approximately $3,000,000, equally divided between the two interests. This was done by depressing the streets and raising the tracks by about an equal amount.

At the present time the city is planning to remove a large number of crossings in South Philadelphia, in which the Pennsylvania and Baltimore and Ohio Railroads are interested. The estimated cost of these improvements is $20,000,000, which will be divided about equally between the city and the railroads.

This work must ultimately go on in all large cities until the last crossing at grade is removed. It is sure to be proceeded with as fast as the several interests can arrange to furnish the necessary means.

An illustration of the attitude of the railroads toward the removal of grade crossings is indicated by a placard recently published by the Pennsylvania Railroad, which is as follows:

What the Pennsylvania Railroad System has done.

There remain on the 11,000 miles of line comprising the Pennsylvania System 13,027 crossings at grade. It costs an average of at least $50,000 to remove a grade crossing. Thus to eliminate every such crossing on the lines of this system would cost upward of $600,000,000. The various companies of this system have since 1902 expended $66,641,294 in improvements, resulting in the elimination of 1052 grade crossings.

An Appeal to the Public.

Grade crossings are unavoidable. Without them few rail-

roads could have been built in this country. They are one of the inconveniences of progress to be eliminated just as fast as possible. Railroad officers are doing their best, but it all takes time and money.

Meanwhile the public demands that trains be run on time. To do so involves speed over crossings. The railroad appeals to the driver of every vehicle and every pedestrian before crossing a railroad to "STOP, LOOK, LISTEN." A little care and a momentary stop may mean the saving of a human life.

Human lives are the most precious things in the world.

ALTERNATING CURRENT TRACTION

ALBERT P. GODSHO, E. E., '14.

The present status of electric traction is such that there is no longer a question as to the superiority of electricity over steam for traction. It is necessary to use high tension distribution on long stretches of main line track from one hundred to one hundred and fifty miles, the usual length of a steam road division, to avoid excessive line drop and large line loss. The problem confronting all interested parties is which kind of high tension traction system shall be employed. The traffic density is usually from 10 to 15 trains in each direction. This is the case with the Chicago, Milwaukee and Puget Sound Railway, one of the prominent western roads, which is contemplating an electrification to ultimately embrace a single track main line mileage of about 800 miles. Naturally methods capable of solving the problem occurring within the limits of a city or a suburban district cannot be applied. The system to be employed must be one that, according to circumstances prevailing, will give the best results with a required minimum of fixed charges.

Two systems are available:

(*a*) Direct Current (trolley voltage, 1200 to 2400).

(*b*) Alternating Current (trolley voltage, 3300 to 15,000, single phase and 3 phase).

The principal advantages of a high voltage direct current system are:

1. Long years of use and consequent high state of perfection of the 600-volt direct current series railway motor (two in series on 1200 volts).

2. The possibility of using a great deal of the low voltage main station apparatus, sub-station and car equipment by reinsulation for higher voltage. These facts in connection with the necessity of a minimum amount of experimental work in the development of new apparatus have induced many companies now employing 600 volts direct current to simply raise their transmission voltage. For example, an interurban car equipped with four 600-volt motors operating at full speed across a 600-volt circuit, by use of higher insulation and some alteration in the control, can be permanently connected two in series for use across a 1200-volt line. These are great advantages, which, coupled with the fact that on the other hand several a. c. installations have been almost failures, have contributed to the great growth of 1200, 1500, 2400-volt d. c. traction.

The principal disadvantage, however, of the d. c. system both from the generating and traction point of view is the problem of commutation. Ordinary practice allows but a 3 to 4 volt difference between commutator segments; with commutating poles higher voltages up to 10 and 12 can be used. The most common plan is to connect two 600-volt machines in series to give 1200 volts. Generators and rotary converters giving 1200 volts are commercially successful; special interpole arrangements are employed in order to make their operation feasible. Commutation will probably continue to be the limiting feature in the d. c. situation.

High tension direct current requires a much more expensive generating equipment than alternating current. With a four motor locomotive at the present state of development the highest direct current voltage that can be employed is 4800, at which potential an efficient speed control is out of question.

As regards the generating end, alternating current undoubtedly is in every way superior to direct current. Alternators have been built which give 30,000 volts direct. Such a

voltage is not feasible with direct current, unless the road is short enough to enable the feeding of the entire system from a single generating station. To a certain extent this advantage is counterbalanced in the case of a single phase system if run from a polyphase circuit, as a great unbalancing of phases will cause a pulsating armature reaction and poor regulation. On the New Haven System the generators carry 300% unbalancing without serious trouble. Being turbo-generators, they have only two poles; if a greater number of poles could be used better results might be obtained. Single phase machines are generally unsatisfactory, mostly on account of poor design features. The polyphase machine is in every respect superior. It is customary to use polyphase generators for single phase supply.

The ease of obtaining high voltages is the striking advantage of alternating current. Their use is limited only by the problem of insulation.

The type of motor, frequency and number of phases are the points which must be decided in case of an a. c. installation. Although an induction motor for general use is in every way superior to the direct current shunt motor, alternating current has nothing that has a like simplicity and gives the same satisfaction as the direct current series motor.

Shunt motors have been tried for traction work, and it is a reasonable supposition that they would be just as satisfactory as polyphase induction motors, which they so closely resemble; in spite of this the attempt to introduce them appears to have been abandoned.

The writer has been attracted by the great simplicity and flexibility of the application of alternating current to traction, and on account of the apparent apathy which a. c. on the whole meets in the United States was prompted to devote the major part of the paper to a. c. traction.

The great advantages of the a. c. system, summarized, are:

1. Use of high trolley voltage.
2. Voltage control by transformers instead of resistances.
3. Regenerative braking and pumping back into the line, relieving the generators.

FIG. 1

FIG. 2

FIG. 3

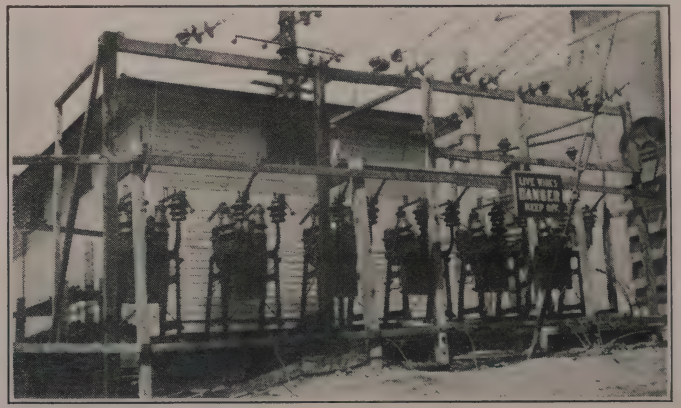


FIG. 4

The principal disadvantage at the present time is the admitted inferiority of the a. c. motors used, with respect to weight, cost, and efficiency as compared with d. c. motors. However, from the operating point of view, a. c. motors are fully as satisfactory.

The following types and systems are the principal ones employed in a. c. traction at the present time.

(*a*) Single Phase Motors:

1. Compensated Repulsion Motor, with short circuited rotor, developed by Latour and Eichberg. It has been used in Europe. Experimental work has been done in America on a locomotive of this type by E. F. Alexanderson, of the General Electric Co.
2. Compensated Series Motor, with special winding to neutralize armature inductance; choke coils and resistance-leads to cut down armature short circuit currents. It has very complicated armature structure. Developed by Lamme, in America, and Eickmeyer, in Europe.
3. Compensated Series Motor, with Shunt Excited Commutating Field—used in Europe on Loetschberg (Simplon Tunnel Line).

(*b*) Polyphase Motors:

Three phase only.

1. With short circuited rotors and stator wound for four combinations of poles—Europe, Simplon Tunnel Line.
2. Wound Rotor, usually two stator windings arranged for different number of poles—speed control either by inserting resistance in the secondary, or operation in concatenation. It is extensively used in Europe, for instance on Vatellina Line and many other roads; only lately in America on the Great Northern.
3. Induction motors of the polyphase type operating on a single phase circuit by means of a phase converter-split phase arrangement. These are in construction for Elkhorn Division of the Norfolk and Western Railway.

Historically, direct current traction precedes alternating

current traction only by a few years. The first tests were made for a. c. traction by the Siemens-Halske Co., of Berlin, Germany, in Charlottenburg-Berlin, in 1892. It was a small experimental installation. The voltage employed was 500 and the frequency 60 cycles. A wound rotor was used. The stator was Y connected at start and ▽ connected when running. The matter was not pushed because there was no need of alternating current traction, as the direct current systems amply fulfilled all requirements at that time.

The Lugano Tramways of Italy, equipped by Boveri & Co., of Basel, Switzerland, were the first commercial application of alternating current high tension traction. The line was about four miles in length.

The first recorded instance in the use of concatenated control is the above-mentioned Vatellina Line, on its Swiss border division in 1901. Italy, Switzerland and Germany are the pioneers in the field of alternating current traction; a single phase system has been in operation in Hamburg, Germany, since about 1903-1904.

A short sketch of several radically different electrifications in the United States and elsewhere will bring out very clearly some of the most salient and interesting features of the single phase and polyphase application in high tension traction.

The Cascade Tunnel on the transcontinental line of the Great Northern Railway in 1904-05 became the limiting factor of the amount of traffic the road could handle. The tunnel is located on 1.5 per cent. grade, with adverse approaches of 2.2 per cent. It was always necessary to wait about two hours, when a train passed through, for the tunnel to clear itself of gases. Steam pressure would drop 50% when the train was half way through the bore. It was finally decided to electrify it in 1906, as the first part of a 60-mile mountain division. To the present time only about three miles of line have been actually equipped. Three phase motors were adopted, because they offered the very attractive feature of regeneration which is an extremely important factor on mountain lines. The first cost was less than for any other system. The complication of two over-head wires is not objectionable for a single-track

mountain line. The trolley voltage is 6600 at 25 cycles. The power house is located 33 miles from the tunnel. The transmission voltage is 33,000, a transformer sub-station being located at the tunnel mouth. The generating equipment consists of two 2500 kv-a 600-volt, 25 cycle generators direct-connected to two 4000-horsepower water wheels operating under 200 feet head. The latter have been the principal cause of trouble, due to poor speed regulation. Automatic water rheostats are provided in the power house at present to aid in braking the trains by regeneration.

The locomotive is equipped with four three phase, 25 cycle induction motors of 475 horsepower continuous rating and 670 horsepower one hour rating. The motors are wound for one set of poles, so that there is only one running speed of 15 miles per hour. Acceleration is by the medium of grid resistances in the rotor circuit. An unsymmetrical arrangement is employed to decrease the number of contactors. The motor voltage is 500, obtained by means of three 400 kw air blast transformers carried on the locomotive. Two single trolley poles are used, spaced five feet apart outside of tunnel, and eight feet inside. These distances prohibit the use of a box trolley. The current input during acceleration is only about 20% greater than normal. Tests have shown that the regenerative efficiency is about 75%. The weight of the locomotive is 230,000 pounds, with a co-efficient of adhesion of about O.20.

The most extensive a. c. installation in America is that of the New York, New Haven and Hartford Railroad Co., from Grand Central Station to Stamford. In the very near future electric trains will be operated as far as New Haven, 75 miles from New York. Twelve miles of the line from Grand Central Station is operated by 600-volt direct current, under joint operation with the New York Central and Hudson River Railroad Co. The remaining 60 miles are operated by 11,000 volts 25 cycle current. The direct current is fed by means of a third rail, the alternating current by an elaborate overhead catenary system. (See Figure 2.) At present there are in use about 100 locomotives; 60 can operate equally well an a. c. and d. c. Extensive freight terminals have been

electrified, and there will be about 550 miles of electrified single track when the system is complete.

The power house (Figure 1) is located at Cos Cobb, 33 miles from New York, and 40 miles from New Haven. No sub-stations are employed and the whole system is fed from the one point by a three-wire single phase system, with 22,000 volts between outside leads, but only 11,000 volts between each lead and the rail. Compensating transformers of 2000 kv-a capacity are located every four miles to take up the unbalanced load. The section breaks are elaborate, oil circuit breakers and disconnecting switches being located here (see Figure 2).

The power house contains eight 2 pole, 11,000 25 cycle, 1400 R. P. M. turbo generator sets of Westinghouse manufacture. The generators are Y connected, the trolley being fed from two ends of the Y. The other ends of the Y are loaded by means of a large number of trolley sub-stations, which the New Haven controls. The aggregate installed capacity at present is about 40,000 KW. Due to severe short circuits and great unbalancing, the generators are designed to hold their rated voltage on six times normal current. At present there occur on the average about two short circuits a day on the system. The load varies 50% in about 30 seconds. The transformers for the 11,000-22,000-volt system are eight in number, oil insulated and water cooled, and of 7500 kv-a rating each. They are located in a special fire-proof building (see left of Figure 1). Another very interesting feature of the station is a 500 kw turbo exciter set, the turbine being of the DeLaval type, operating at 900 r.p.m. and driving the generator through herringbone reduction gears. The oil circuit breakers (Figure 4) handle the entire load of the system. At peak loads 30,000 kw pass through the wires seen above. The entire station is modern, and thoroughly up to date in every respect, and is well worth a visit.

There are several types of locomotives in use for switching, freight and passenger service. A picture showing the general characteristics of a passenger locomotive is shown in Figure 3. The main features of a 110-ton locomotive are as follows:

It is equipped with four single phase compensated series

twin motors geared to four driving axles by means of quills. The nominal rating of each motor is 400 horsepower on 300 volts alternating current. The motors operate at 240 r.p.m. at rated output. Their power factor is about 0.85 under these conditions, the efficiency nearly the same (see A. T. E. E., Vol. XXX, p. 1400, for performance curves of this motor). The motors are notable for their large commutators with a large number of bars, in the neighborhood of 200. This is done to cut down sparking by reducing the voltage between the bars. The weight per horsepower is much greater than of a direct current series motor of the same rating.

Speed control is by means of an auto transformer; 13 running speeds are available. The main control circuits are electro-pneumatically operated. An ammeter and voltmeter are included in the control apparatus. Current is collected from the trolley by two pantograph rigs, air operated. Oil circuit breakers are employed on the locomotive; multiple unit equipment is provided, so that two or more locomotives may be operated from one point if desired.

The running gear of the locomotive consists of two trucks, each with four drivers and two pony wheels connected by a hinge, known as the articulated type. The pony wheels were not attached to the original locomotives, but several derailments caused their attachment. No further trouble has been experienced since.

The New Haven locomotive is handicapped in that it has to operate equally well on direct current, requiring additional apparatus. In passing Woodlawn, the point of change from alternating to direct current, even an experienced observer has to pay close attention to detect the change.

The elaborate overhead suspension system is worthy of note. As will be seen from Figures 2 and 3, a three-wire catenary scheme is employed. The three wires are held apart by a wire triangle, as shown, decreasing in size toward the middle of the span. The lower one of the two bottom wires is of steel and is the one on which the trolley rubs directly. The wire above this is the copper feeder. The triangular cantenary construction was adopted to prevent swaying in the horizontal and vertical plane due to high speed of trains.

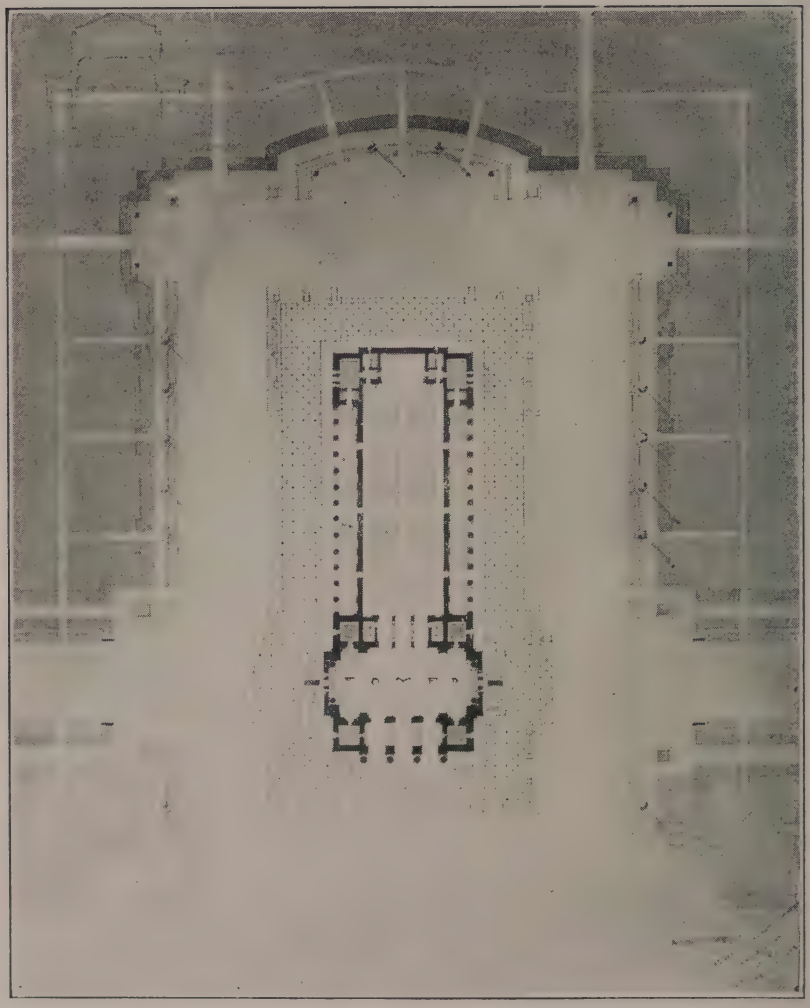
A very notable and recent European installation is that on the Loetschberg Line, in Switzerland. The line voltage is 15,000 and the frequency is 15 cycles. The locomotives are striking. There are two 1250-horsepower, 500-volt, single phase compensated, commutating pole series motors coupled to ten drivers, five on each side, by means of a jack shaft and cranks. The motors can be operated singly, parallel or in series. Each motor weighs 14 tons. The average powerfactor is 0.95, and the overall efficiency at full load is 84 per cent. All control circuits are electrically operated by direct current, furnished by a motor generator set. These locomotives are among the largest ever built.

The single phase electrification of the Norfolk and Western Railway in West Virgina, employing the split phase arrangement, is the first of its kind in the world. Polyphase motors are employed, with two sets of windings to give a different number of poles. There are three running speeds of 7, 14 and 28 miles per hour. The first is obtained by connecting the two motors in concatenation. Altering the winding gives the second and third speeds. Acceleration between these steps is provided for by proper insertion of secondary resistance. The normal rating of the locomotive is 1300 horsepower. It is intended to use regenerative braking.

The great preponderant problem is the movement of a given tonnage with as small a generating equipment as possible. This can be accomplished only by scientific train dispatching and regeneration by trains. When a train is starting up a grade on one part of the line, another will be descending on a different part of the system and help the power station to raise the ascending train. To accomplish this a reasonable traffic delay must be permissible.

In the meantime the Chicago, Milwaukee & Puget Sound Railway, mentioned in the introduction, has decided to use 2400 volts d. c. for the contemplated electrification of their road, and it will doubtless be of absorbing interest to learn the reason of their choice.

Notwithstanding this decision in favor of direct current, it is an undeniable fact that a vast amount of scientific development and commercial exploitation of alternating current high tension traction will go side by side with the direct current high tension traction.



"A MOVING PICTURE THEATRE" (PLAN)
WALT. ANTRIM, ARCH. '15

THE INVENTION AND DEVELOPMENT OF THE SLIDE RULE.

G. H. Eckhardt, Ch. E., '14.

The seventeenth century was most generous in its contributions to science, and to fully realize this we need only recall that it was in the sixteen hundreds that logarithms were invented by Napier and Briggs, that analytical geometry rose thru the efforts of Descartes, and that the calculus was evolved by Leibnitz and Newton. In 1609 Kepler published the first two of his three laws that later formed the foundation of modern astronomy, and in 1638 Galileo brought forth the laws of projectiles. These are only a few of the achievements of a century that claims, besides Newton, Descartes and Galileo, such men as Sir Christopher Wren, the architect of St. Paul's, London; Hooke, Huygens, and Halley, the discoverer of Halley's Comet.

In the midst of such great scientific works the slide rule had its birth; and yet, despite the fact that it dates back to the first half of the seventeenth century, it was little known and very little used in the United States before 1880 or 1885, its popularity really beginning with the introduction of the Mannheim type in about 1890.

Now it was the invention of logarithms by John Napier (1550-1617) in 1614 that made possible the subsequent invention of the slide rule. Not long after this, in 1620, Edmund Gunter, professor of astronomy in Gresham College, London, designed the logarthmic line of numbers which was the necessary prelude to the slide rule. Gunter's Scale, as this line of numbers was called, consisted merely of a straight line with the digits 1, 2, 3, . . . 10 so arranged upon it that the distances between the numbers along the line were not proportional to the numbers, but to the logarithms of those numbers. Compasses were used to add or subtract distances along the line, and, according to the properties of logarithms, products and quotients could be obtained.

The invention of the slide rule has been frequently but erroneously attributed to Gunter, but it will be seen that Gunter's Scale had, in reality, no sliding part and could not, therefore, be called a slide rule. As late as 1868, however, the slide rule is

described under the name of "Gunter's Line" in Appleton's "Dictionary of Engineering" (Vol. I).

In the past some authorities have attributed the invention of the slide rule to Edmund Wingate, while others named William Oughtred as the inventor. It is certain that Wingate did not invent a slide rule prior to 1630, for in that year he published a work in which he described a "line of proportion," which he himself said was "nothing else but a mechanicall table of logarithmes."

William Oughtred, in 1630, showed to his pupil, one William Forster, notes in Latin and instruments which proved to be the first slide rules. Two years later Forster, with the consent of Oughtred, published in London a work called "The Circles of Proportion and the Horizontal Instrument." The description of Oughtred's "Circles of Proportion"—which consisted of two pointing radii attached to the center of a circle about which were drawn concentric circles, each charged with a logarithmic scale—is most interesting, particularly so since it is the description of the first slide rule invented. Later, in 1633, appeared a description of a rectilinear instrument, the parts of which were kept together by hand. William Oughtred appears to have been a man of considerable intellectual capacity, and to have been held in high esteem as a scholar, for a few years before his invention of the slide rule he had been consulted by Briggs on a design to perfect Napier's logarithms.

Upon the continent we find mention made of a device that appears to have been a circular slide rule—invented by one Jean Baptiste Clairaut—among the machines and inventions approved by the Royal Academy of Science of Paris in 1627. The first description of a slide rule in German was published by Biler in 1696, and a later writer, mentioning Biler, described an instrument much like the modern slide rule.

It is to Seth Partridge, a surveyor and teacher of mathematics, that the invention of the slide is due. The rules of Partridge, described in a work published in 1672, "were separate and made to keep together in sliding by the hand. . . ., one ruler sliding between two others kept together by pieces of brass." It was the great Sir Isaac Newton who suggested the use of the runner or index, but the runner did not make its appearance on

slide rules until the latter quarter of the eighteenth century, when it appeared on rules made by one John Robertson.

The slide rule owes its present form largely to Amedee Mannheim, a French army officer, in Metz, who designed a straight slide rule—in about 1850—that experience has shown to be admirably suited to the ordinary every-day uses of the slide rule. Born in 1831, Mannheim entered the École Polytechnique in Paris in 1848, and then, as a lieutenant of artillery, went to Metz. Later Mannheim had a long and illustrious career as professor of geometry at the Polytechnique, "where he rendered long service and enriched geometry and mechanics with new researches."

Such, in brief, is the history of the slide rule; but we have not yet reached a state of perfection in the Mannheim type, for already a modification of this type is being used in the technical schools of Paris, for which greater speed and accuracy is claimed. The slide rule may be applied to almost any calculations, and in the 256 types of slide rules devised since 1800 we find many designed for special computations, such as the computation of annuities, the strength of gear teeth, and the flow of water.

It would be hardly fair to conclude this paper without making mention of the fact that the slide rule made its first appearance in an American publication when mention was made of it in 1805 by Robert Patterson, then Professor of Mathematics in the University of Pennsylvania.

"A MOVING PICTURE THEATRE" (ELEVATION) WALT. ANTRIM, ARCH. '15

PROPOSED METHOD FOR LIGHT SEASHORE BUILDING CONSTRUCTION

MALCOM DUNCAN, C. E., '15.

The storms that recently swept the entire New Jersey coast are now a matter of history. In some places, like Sea Bright, there was considerable destruction of property, great anxiety, but no loss of life. A large number of owners having their property located near the beach front are now seriously considering whether the past storms were of maximum violence. If the wind velocity had been much higher and of larger duration, thereby increasing the height of the waves, the destruction would have been incalculably greater. As these conditions are within the range of probability, all possible precautions should be taken against a future catastrophe. The old bulkheads, composed of piling driven into the sand, proved insufficient to resist the continuous pounding of the waves. It is, therefore, necessary to use a more permanent form of construction for the buildings themselves.

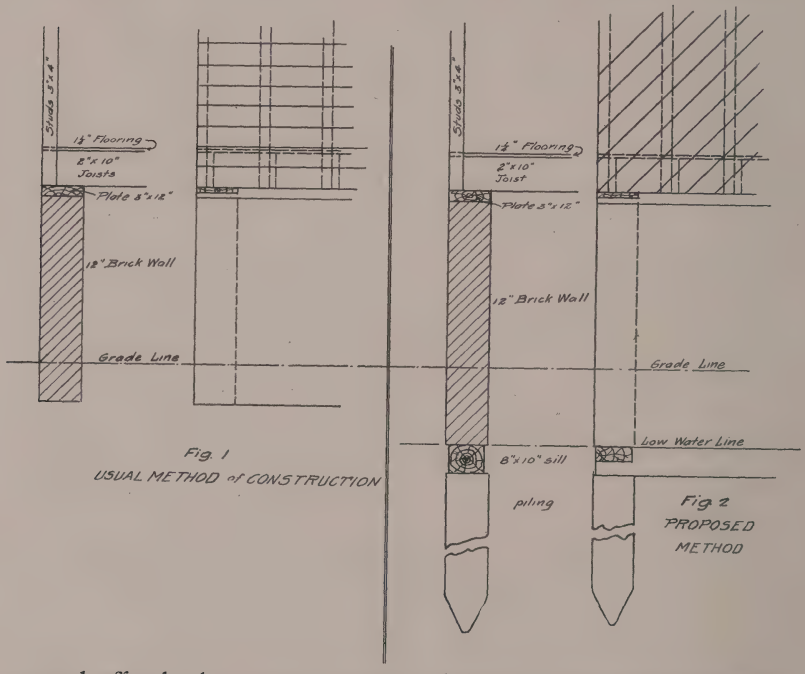
The usual method of seashore building construction is to erect the structure directly on the sand, without foundations of any kind. This simply invites disaster. The overflow of even a small amount of water washes the sand from underneath the walls of the structure, which, if continued for even a short time, causes its speedy collapse.

Presumably the majority of the cottage owners are ignorant of the low cost and simplicity of driving piles for foundation purposes. The piles may be of wood, iron, steel or concrete. The wooden piles only will be considered in this discussion, as they are cheapest and usually adequate for this kind of construction. Various kinds of timber are employed, but spruce and hemlock are best suited for soft soils. The size may be from 6 inches to 8 inches at the lower end, 14 inches to 18 inches at the upper end and 20 to 25 feet in length.

In sandy soils the only method of sinking piles is by means of a water jet. The drop-hammer and steam-hammer pile-drivers are worthless, since the sand acts as a cushion to the action of both. The method of sinking piles by a water jet is very simple and inexpensive. A jet of water under pressure is forced into

the sand just below the point of the pile. The sand is thus loosened and the pile sinks either by its own weight, or by the aid of light blows from a hammer. Experience has shown that it makes little difference, either in the rapidity of the sinking of the pile, or the accuracy with which its position is preserved, whether the nozzle is exactly under the point of the pile or not.

Precautions should be taken to use a pump of sufficient capacity for the pumping of the water. The direct acting and centrifugal pumps are the best types for this work. The first



named affords the greater power, while the latter has the double advantage of a lower first cost and of allowing the sand and gravel to pass through without injury to the pump. After the piles have been sunk to the proper depth they are cut off about a foot below the low-water line. Substantial sill pieces of either spruce or hemlock should be securely spiked to the tops of the piles. It is, of course, necessary to keep the sill pieces as well as the piles below the low-water level; otherwise the timber would be subjected to the alternate wetting and drying, which would cause rapid decay.

The brick walls or piers may be built directly upon the sill pieces and anchored to the same by bolts let into the sills and built in the walls.

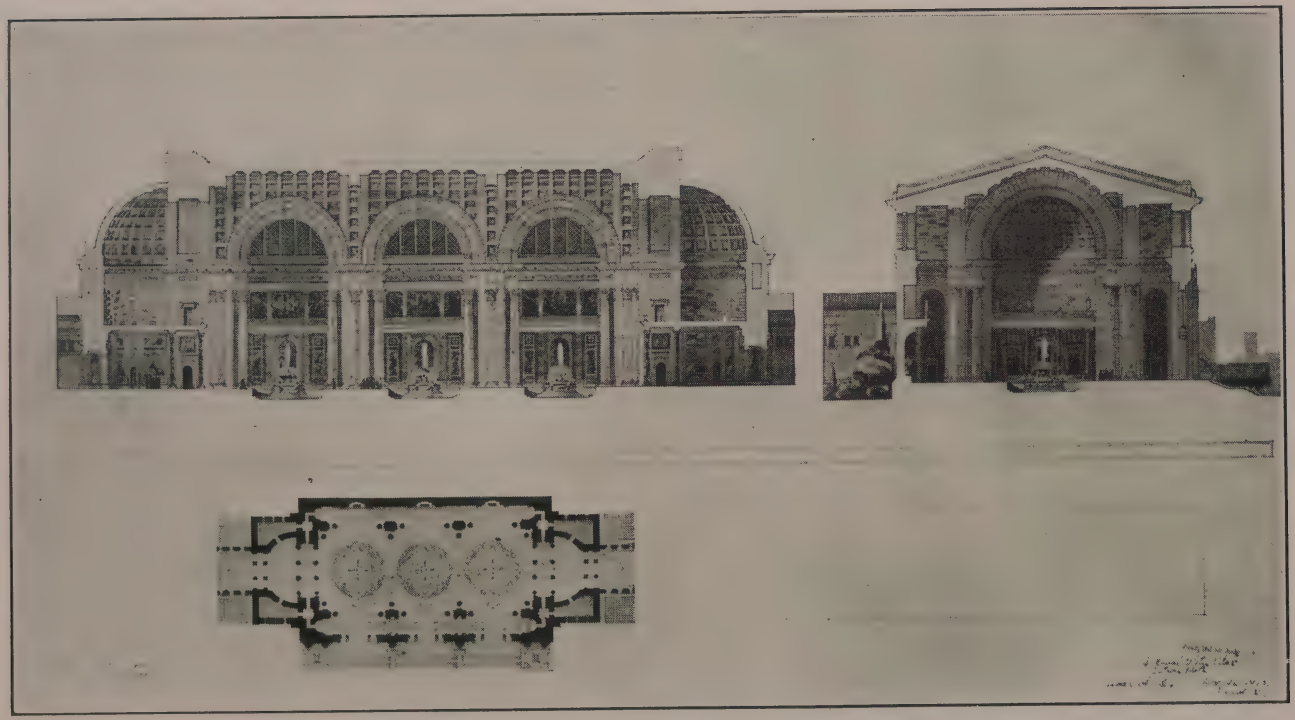
After the foundations are properly constructed it is necessary to protect the upper part of the structure from the pressure of wind at high velocities. A fundamental principle of construction in the building of seaside cottages, which is more honored in the breach than in the observance, is that effective diagonal bracing should be provided. The usual method of building is to erect first the uprights or so-called studding, which form the skeleton of the building, and then to sheath the building at right angles to the studding. This is a direct violation of safe building principles, as the structure then offers little resistance to the wind pressure except by its weight. This is usually too small to be considered. In the absence of the diagonal bracing of the structural members, the sheathing should always be nailed diagonally to the uprights, thereby changing the direction of the stress and materially increasing the stability of the structure.

Referring to Figs. 1 and 2, it is seen that the ordinary method of construction forms a series of rectangles, while the correct method forms a series of triangles. We know that it does not require any great force to deform a rectangle into a rhomboid, while a triangle cannot be deformed without changing the length of one or more of its sides. It is thus readily seen that with diagonal bracing or sheathing a greater force is required to tear a building apart, or to blow it out of shape, or to demolish it, than in the case of right-angle sheathing without adequate diagonal bracing.

SALT AND THE ELECTRIC CURRENT

F. SIDNEY DEACON, Ch., '14.

In a number of cities in this country, notably at Niagara Falls, there are plants which electrolyze sodium chloride, or common table salt. The final products of this process are caustic soda and chlorine, either as liquid chlorine, or as bleach or chloride of lime. These plants necessarily have cheap electric power, for a large amount of current is consumed in the electrolysis.



"THE CENTRAL HALL OF A LARGE MINERAL WATER ESTABLISHMENT"
FIRST MENTION, FIFTH GRADE DESIGN, EDGAR A. SELF, SP. '14
(Courtesy of Alumni Register)

For the most part the salt is taken from the mines of Michigan, or from those in the vicinity of Rochester, N. Y. The salt is removed from the cars, and made into a strong brine solution, which is run into the cells where the main action takes place. The cells are of different types, but all work on the same principle. As soon as the current acts on the brine the sodium is attracted to the kathode, or negative pole; here it forms caustic soda and hydrogen is given off. The chlorine is attracted to the anode, is evolved as a gas, and is transferred by a slight vacuum to the bleach house. Between these two electrodes a porous diaphragm must be inserted to keep the chlorine and caustic apart, and here the various cells differ vastly.

The "anode liquor," a weak solution of caustic and salt, is drawn off and pumped to large triple or quadruple effect vacuum pans, where most of the water is evaporated. The liquor is now settled and filtered to remove the salt and other impurities. The strong caustic liquor is further evaporated in large cast-iron vats, heated strongly, and the molten caustic poured into sheet-iron drums and allowed to solidify. This caustic is now ready for the market, and is used to the largest extent in paper pulp mills and soap manufacture. It is also used in textile works for "mercerizing" cotton, making artificial silk, etc., while our common lye is largely caustic soda in an impure state.

The chlorine is drawn from the cell house by means of fans, and either subjected to a pressure sufficient to liquefy it, and sold as liquid chlorine, or is absorbed in slaked lime in large chambers, forming bleach. The liquid chlorine and bleach are used in industries that require a bleach, such as laundries, paper mills, textile factories, etc. The bleach is more bulky, but is less dangerous, than the liquid chlorine. Bleach is shipped in large sheet-iron drums of about 600-700 pounds capacity. It is a splendid disinfectant, and even the so-called "low-grade" bleach, which comes to us in the form of chloride of lime, is an excellent disinfectant. This contains from 30-33% of available chlorine. One part of chlorine is sufficient to sterilize one million parts of water. Our own city water is sterilized in this way.

In this industry, despite all precautions, minor accidents are very common; caustic burns and doses of chlorine gas are frequent among the careless or ignorant workmen. A peculiar fact is that bleach destroys cotton and does not affect wool clothing, while caustic attacks wool and leather, though it does not affect cotton. The man who has work in both departments is rather at his wits' ends to dress suitably for both the caustic and chlorine, and often is disposed to think "into what a nuisance this salt can be made," while we, who benefit to a greater or less extent, may justly marvel at the wonders that can be accomplished by the action of the electric current upon our common table salt.

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of

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(WHITNEY MAGAZINE)

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EDITORIAL

Results

With the March issue the Journal enters the third month of its existence. The results so far are good, but there is, however, much yet to be accomplished. To the Mechanical, Electrical and Chemical Engineering Departments an undergraduate publication is somewhat of an old story. Now that the complexities of reorganization and construction are passed, let all our energies be directed towards the promotion of the Journal.

Our New Office

Through the efforts and interest of Professor J. J. Morris, Chairman of the Publication Committee, Room 204, a spacious office in the Engineering Building, has been obtained for the new headquarters of the Journal. Professor Morris and Professor Temple have also been instrumental in the furnishing of this room. A flat-top oak desk, staff table, shelves, small tables and chairs are already in place and a book-case and rug are in sight. We greatly appreciate these favors and feel that much has been accomplished in the permanent establishment of the Journal and in the comfortable housing of the staff.

We still feel, however, that the Houston Club is the most logical and most advantageous location for the office of such a publication as ours. This club is an undergraduate organization and is maintained by the fees of some twenty-two hundred students, of which the Towne Scientific School comprises nearly one thousand, or about forty-five per cent.

The School does not, however, have ten per cent. of the privileges in room space. We feel that the time is ripe for a readjustment of or for some additions to the Club.

Success

This year's Architectural Show, "The Blue Smock," made one of the "biggest hits ever!" The plot of the play was new, the cast and chorus were well selected, the scenery was cleverly and well done, the costumes were appropriate; in fact, everything was done to make the show "take well." It did "take well" and in this respect was a great success. But was the show a success? Did the profits repay the efforts? If not, why not?

There were fifty men working on the play for three weeks previous to its production, and between seventy-five and a hundred during the week of the play, say an average of fifty men for four weeks. Did the profits pay for the time these men expended? They should have. Why didn't they?

There was one thing evident to any one who took occasion to look into the Grub Street Theatre before, during or after the show. A lack of economy, waste of materials, time and energy, due to the fact, undoubtedly, that the show had too many heads all working independently. The manager was

a manager with too many assistant managers and not enough assistance.

The one thing to make the show a success in every way is to cut the expenses, thereby increasing the profits. This can be accomplished only in having one manager, a man with full authority, whose signature shall be required on all orders for materials, and whose O. K. must appear on all bills paid.

The authors, who are paid for their services, should only offer suggestions to the manager and he in turn should have full power to act at his own discretion. With a manager so empowered the architectural show could be made a complete success.

The Six-Year Course

The combination of a college and engineering course is a great step in the movement for the broader education of technical men. The chief feature of this change is that a man can derive all the benefits of both college and technical studies in six, rather than in eight, years. It is well known that many mere technically trained students lack the breadth of view and general knowledge that exists among their collegiate brothers. These seem sacrificed for mere discipline.

There are also many men graduating at a too tender age, and their lack of maturity is a tremendous handicap during the early years of their profession. Such men do not have the prestige or command the respect which two years, or even a year more, of education would enable them to gain. Two years in a college course previous to entering the study of a technical profession would rectify many of the fallacies of the present-day "four-year" engineer.

Such a combination of college and scientific work is to be heartily recommended to the younger men and to those whose time and financial condition will allow.

Managing Men

One of the greatest faults with many graduating engineers is their inability to understand men or human beings of other than their own station in life. This is the result of general inexperience, narrow-mindedness and selfishness. One cannot expect to direct or manage others without acquiring a broad, honest conception of human nature in all its varied forms.

The sooner such qualities are developed the better. One of the most effective methods is that of teaching mechanics or artisans. It is surprising the amount of practical knowledge and general understanding that can be derived from work of this nature. The college man meets the practical man and each gives to the other. This reciprocation is a decided benefit to both, and the results are two-fold. Then, too, there is a feeling of satisfaction in doing something for your fellow-men.

Parasites

University students today can be divided into two broad classes—Hosts and Parasites. No matter into what department you may go you will find the workers and the drones; the men who are willing to do the work, and the men who are willing to use the results of their friends' efforts; the men who are only too glad to give their time to helping Pennsylvania, and the men who are satisfied to say "I am from Pennsylvania."

The Architectural Play clearly demonstrated this division. The authors, cast, chorus, orchestra, scene painters, carpenters, ticket managers and house manager had their work before them, and they did it. How many were there that gave all their time to the glorification of the Architectural Department? Outside of the cast, chorus and orchestra there were five scene painters, three carpenters, three electricians, two ticket managers and a house manager. These men were the workers, or the hosts. What were the two hundred other members of the department? There is but one classification open, they were the drones, or in other words, parisites; the men who shared the honor in having come from a department capable of such results, but gave nothing towards making the show the success that it was.

There is at all times a chance for a man to change. You can make the change. Will next year find you a host or a parasite?

Appearance

One of the most noticeable features in a man's personality is his appearance. Too few engineers and architects realize the value of their impressions upon others. From a commercial standpoint, a clean-cut, well-groomed man will have entre where the care-

less, ill-appearing man will not be received. A man can be trim and up to date in his dress and yet not be termed a sport. Many do not appreciate this fact and, after all, it is only a symbol of self-respect.

Getting Into and Starting Something

Many students never seem to interest themselves in things other than their books. In a great university such as ours and in the Towne Scientific School there are numerous activities to interest one. Some are dubious and others decide to start something, but that is as far as they get. Jump in and take the step, for it will be found that the little things lead up to the big things and that one obtains experience, executive and administrative ability which otherwise would be lost. Try a little of the "Wisconsin Idea."

Reading

The value of a weekly perusal of engineering and architectural publications, a mental digestion of their editorials and an examination of their advertisements should be realized by engineers and architects. Every man from the Freshman up should acquire this habit. The collection of trade catalogues, oft-times text-books in themselves, and visits to professional society meetings are also of a broadening nature.

ARCHITECTURE

Cards are out announcing the marriage of Miss Frances Hoover Anderson to Geo. Edward Brumbaugh, '13, Arch.

Grant M. Simon, winner of Paris Prize, sailed for Paris February 6, to take up his work in the École des Beaux-Arts.

The following old graduates called at the department: Mark Lansburg, class '13; W. H. Shearer, '13 Sp.; F. C. Wiest, '11; Raymond W. Bristol, '09; Walter S. Cohen, '12; J. Weitzen, M. C., '11.

CIVIL ENGINEERING

W. B. Patton, '80, is Managing Owner of the Duluth Engineering Company, Duluth, Minn.

H. B. Hirsh, '83, is Vice President and General Manager, Belmont Iron Works, Philadelphia, Pa.

C. H. Haupt, '86, C. E. '87, is Chief Engineer of the Standard Oil Company of New Jersey, Elizabeth, N. J.

G. B. Harris, '88, C. E. '89, is President of the York Haven Water and Power Company, Philadelphia, Pa.

T. W. Hulme, '89, C. E. '90, is Real Estate Agent of the Pennsylvania Railroad Company, and General Secretary of the Presidents' Conference Commission, Federal Valuation of Railroads, Broad Street Station, Philadelphia, Pa.

R. L. Humphrey, '91, C. E. '04, is Consulting Engineer and President of the American Concrete Institute, Philadelphia, Pa.

J. C. Newlin, '93, is partner in W. W. Lindsay and Company, Contracting Engineers, Philadelphia, Pa.

R. D. Coombs, '94, C. E. '95, is President of R. D. Coombs and Company, Engineers and Contractors, New York, N. Y.

H. W. Thornton, '94, has recently been appointed General Manager of the Great Eastern Railway, in connection with a general plan of reorganization. Mr. Thornton is the first American engineer appointed to a responsible executive position on an English steam railway system. Mr. Thornton has resigned his office of General Superintendent of the Long Island Railroad Company, which forms a part of the Pennsylvania Railroad Company, with a view of assuming his new duties in England in the near future.

J. H. Fichthorn, '96, is Chief Engineer of Schuylkill Bridge Works, L. F. Shoemaker and Company, Philadelphia, Pa.

W. R. Hillary, '97, is Supervising Engineer of the Central System, Pennsylvania Railroad Company, Toledo, O.

J. Wilhelm, '98, is Engineer of Construction of the Union Bridge and Construction Company, Kansas City, Mo.

D. S. Gendell, Jr., '99, is Engineer of Erection of the McClintic-Marshall Construction Company, Pottstown, Pa.

J. D. Faires, '01, is Superintendent of the River and Harbor Improvement Company, Philadelphia, Pa.

P. H. Wilson, '01, C. E. '01, is Secretary of the Association of Portland Cement Manufacturers, Philadelphia, Pa.

O. T. Waring, '02, is Superintendent of the Waycross District Atlantic Coast Line Railroad Company, Waycross, Ga.

H. T. McDevitt, '03, is General Manager of the Ocean City Electric Light and Railroad Companies, Ocean City, N. J.

G. C. Munoz, '03, is a member of the firm of Munoz and Munoz, Contracting Engineers, Los Angeles, Cal.

H. E. Hilts, '05, is Road Engineer with the Association of American Portland Cement Manufacturers, Philadelphia, Pa.

T. H. Griest, '06, is Assistant Engineer with the Bell Telephone Company of Pennsylvania, Philadelphia, Pa.

C. S. Bilyeu, '07, is the New York Representative of Colby and Christie, Consulting and Inspecting Engineers.

H. Bortin, '07, C. E. '12, is Assistant General Secretary of the Presidents' Conference Commission, Federal Valuation of Railroads, Broad Street Station, Philadelphia, Pa.

R. C. Newbold, '08, is Chief Engineer of the Allyn Engineering Company, Cincinnati, O.

ELECTRICAL AND MECHANICAL ENGINEERING

David Townsend, M. E., '76, is Mechanical and Consulting Engineer in Philadelphia.

Charles Summer Williamson, M. E., '77, is continuing in the position of instructor in Mechanical Drawing, Girard College, Philadelphia, Pa.

Francis Newland Paris, '82, is Chief Draftsman and Department General Superintendent of the Motive Power P. R. R. Co., Altoona, Pa.

George Kingsbury Fischer, M. E., '86, has retired and at present is residing in Switzerland.

Joseph D. Israel, College, '86, of the Philadelphia Electric Co., was re-elected General Secretary of the Illuminating Engineering Society for 1914 at the meeting recently held in Pittsburgh.

Rudolph Howard Klauder, E. E., '90, is connected with the National Carbon Co., Cleveland, Ohio.

Francis Head, M. E., '92, is Chief Engineer of New Construction Department of the Pierson Engineering Co., located at Sad Paulo, Brazil.

William Brown Brendlinger, M. E., '00, is Manager of the Pittsburgh Branch of the Ingersoll Rand Co.

Henry Gibhart, E. E., '04, has been appointed General Manager of the Oakwood Street Railway Company, Dayton, Ohio.

Roy Lewis Peterman, E. E., '10, is in the position of Superintendent of the Electrical Department of the Northern Indiana Gas and Electric Co.

H. B. Price, Jr., M. E., '10, was married to Miss Clara Hallis Gilpin, of Philadelphia, on October 29, 1913. Price is

the Assistant Superintendent of the Stonega Coke & Coal Co.'s plant, at Stonega, Va.

A. R. Markland, E. E., **'12,** is a special apprentice with the Pennsylvania Railroad Co. and a member of the Altoona Railroad Club.

E. K. Karcher, E. E., **'13,** has been transferred from Norristown, Pa., and is now a cadet engineer with the Syracuse Light Co. (U. G. I.)

W. B. Taber, M. E., **'13,** was married to Miss Sophie Elizabeth Simonds, of New York, on November 8, 1913.

ARCHITECTURE

"THE BLUE SMOCK."

HAROLD HAMMOND, Arch. '15.

Among the architects there are many diverse folk, and they have the gift of knowing how to work. Each succeeding year, the Architectural Show is better than the year before and this year's was no exception. There is a reason. It takes several things to make a good show. It takes a clever fellow, or fellows, to write a good play, a bunch of good actors to present the play, good singers, dancers, carpenters, scene painters, electricians, musicians, posters, and last, but most important of all, it takes enthusiasm. Enthusiasm is the moving impulse that brings all these fellows together, working with all their might, and puts life into the product.

This year we have had less time than ever before in which to work up the show, yet it has gone through with such a burst of enthusiasm and such a grist of hard work and good feeling that the universal comment is "better than ever before." We hope it will always be thus. Each year we have a larger group from which to draw our artists, hence we are never at a loss to find some one to play almost any part imaginable. It might be well to call attention to the fact that the cast this year was almost an entirely different set of fellows from last year's company. This shows well that we are never dependent upon any particular set of "stars" for the

success of the production. No matter what the requirements there is always some one to fill them.

For the benefit of those readers who did not see the show, it might be well to give a short account of the play.

The whole trouble is started, of course, by a love affair. The marriage of the hero and heroine is forbidden by her father until the hero shall come into the possession of $100,000. It is a mean, mercenary stipulation, but charming girls are prone to have such fathers. The hero, however, is possessor of a lottery ticket which gives him sweet dreams of winning a hundred thousand, and, with the careless manner of all true born architects, he sticks it in the pocket of his smock. It serves him right! (Whoever heard of putting anything in the pocket of a smock?)

His negro servant finds the ticket and thinking that it is a long-lost laundry ticket, starts off for the laundry with it. A classmate of the hero, son of the President of Mexico, is called home to help his father in the war. He takes the smock with him by mistake. Now, the hero receives a telegram that his ticket wins, he also finds out where the smock has gone and is helped out of the difficulty by an Englishman, who offers the use of his yacht in pursuit of the smock. The hero and his friends leave immediately for Mexico. After they have gone the negro servant enters with the ticket, which the laundry man has rejected.

The next scene is laid in Mexico, where a charming inn scene is enacted. The inn-keeper informs the smock-hunting party that the President's son, now Generalissimo of the Army, cannot be reached, but that his servant might be informed concerning the smock. The servant is sent for, but refuses to relinquish the smock. He, however, agrees to give it up if the Englishman, for whom he has conceived especial contempt, can successfully take his place as toreador in the bull fight which is immediately to occur. The Englishman does all this and more. He chases the bull all around the stage, much to the amusement of the audience, and to the final discomfiture of the bull. The smock is recovered and much consternation and dismay ensue when the ticket is not found in the pocket. Things are all at a dead

halt when in rushes the negro servant and announces "Dis heah ticket am no good fo' no londry nohow," etc., and after a transport of joy taking the form of a terpsichorean performance, they all live happily ever after.

Some one may ask, "What good does the show really do?" We think less of him for asking, but will give reply. It is all to the glory and betterment of the school. The actual work of preparation and performance bring the fellows into closer fellowship, stir relations and make friendships, otherwise neglected, and promote a spirit of general good feeling, besides giving numerous individuals the opportunity of acquiring experience in lines out of the ordinary run of things. For example, each show practically makes a scene painter. A man starts in with perhaps a little experience and more ideas and finishes as a master hand.

The proceeds of the show are to be invested in an Architectural Year Book, which in itself is a worthy end for all the labor.

The Architectural Play.

"The Blue Smock," the twelfth annual play of the Department of Architecture, had its customary run of a week, with full houses, February 2 to February 9. This year's play lived up to the motto, "A better show in every way each year," and merited the warm reception given it.

The cast, although it contained but one or two of last year's stars, carried out the plot with unusual ability. The character parts were well taken and made some of the "hits" of the show. The music was clever and catchy and sold better than any of the previous shows. The dancing chorus was a decided improvement, and backed by the addition of the singing chorus certainly demonstrated the advisability of having two choruses. The two specialties, the Banjo duet and the Troubador Chorus, were very entertaining and were greatly appreciated, several encores being called for each evening. The orchestra of sixteen pieces deserves a great deal of credit for their selections, which were well rendered. The scenery was more cleverly executed than ever before, the first act far out-

Photo by Lewis, Arch. '14

Photo by Kevorkean, Arch. '15

Photo by Lewis, Arch. 14

classing any first act setting ever put on in The Grub Street Theatre. The second act was better done than any heretofore and "took" exceptionally well with the audience.

In fact, everything taken into consideration, the show was one of the best productions ever turned out, and was certainly a credit to the department as a whole. The enthusiasm with which the men entered into the show is to be commended, but the object of the show, the publication of a Year Book for the University, is especially to be praised as making the show decidedly worth while.

CHEMICAL ENGINEERING AND CHEMISTRY

THE PRIESTLEY CLUB.

On December 12th the Priestley Club held its annual Christmas play and smoker in the Harrison Laboratory. "La Belle Pipette" was the name of this year's production, the author or authors remaining anonymous. The story of the play centered about a co-ed who had entered the course in chemical engineering, and it tells of her experiences during three years of her stay in the Harrison Lab. Gunion, in the title role, scored a great hit, his "Dance of the Seven Vials" in the second act winning well-merited applause. Lehman, Eckhardt, Green, Spooner, Deacon, Applebaum and Alkus took the men's parts —all most credibly. Fisher, Landis, Palmer and Whelan made up the chorus. After the show short talks were given by Dean Frazier, Professor Fernald, ex-Provost Harrison and Professor Temple, Dr. Smith concluding with a great talk on Joseph Priestley. Eats consisting of sandwiches, coffee, ice cream and cake were then served. A liberal supply of cider and pretzels was on tap all evening, and there were cigarettes, pipes and tobacco for every one. There were over 200 people in the audience, a good portion of them being alumni and prominent faculty members.

On February 12th Dr. Jacob Goldbaum (formerly connected with the University as instructor in electro-chemistry and now with Fels & Co.) gave us a talk on the soap business. The chemical quartette helped to liven things with a little

close harmony. A novelty in the eats line featured the evening—hot coffee and "dogs" being served instead of the usual ice cream and cakes. The meeting was very well attended.

CIVIL ENGINEERING

"FOUNDATIONS."

An illustrated lecture on "Foundations" was delivered to the Junior and Senior Engineering students on Friday, January 16th, by Mr. Edwin S. Jarrett, Vice President of the Foundation Co., of New York City. Mr. Jarrett has worked on foundations for twenty-five years and is now one of the country's foremost men along that line.

Various methods of laying foundations were described, the pneumatic method claiming the most attention. Instances were cited in which a great deal of money was wasted through lack of complete data, in some cases complete failure resulting from ignorance of conditions. Because of the uncertain nature of the work, special attention was called to the necessity of obtaining all possible information before starting a foundation.

CIVIL ENGINEERING SOCIETY.

Since the last edition of the "Journal" the Civils have held three meetings, two of which were addressed by members of the Senior Class, the third by one of the officials of the newly-organized Transit Commission of the City of Philadelphia.

The speaker at the December meeting was B. A. Owen, C. E., '14, whose subject was "The Philadelphia & Reading Railway Company's New Bridge at Glen Moore, New Jersey."

Mr. C. R. Stevens, of the Transit Commission, addressed the Society on the evening of January 9th. Mr. Stevens selected as his topic "The Installation of the High-Pressure Service in Philadelphia," and it proved highly interesting and instructive.

The Society was addressed by its President, A. H. Hillman, at the February meeting. President Hillman spoke on "The Rockville Jump-Over."

All the meetings were well attended and the interest displayed was very encouraging to the officers. During the present term some interesting talks have been arranged, and the attendance of every man in the Civil Engineering Department is urgently requested. Keep your eyes on the C. E. Bulletin Board for the notices. You can't afford to miss one single meeting.

"THE FACULTY BAWL."

The second "Faculty Bawl" was held in the C. E. Society Room Thursday evening, December 19, 1913. This Christmas festival has a regular place now on the C. E. calendar. It is looked forward to with great eagerness by the student body, and with a feeling of anxiety, more or less, by the members of the faculty.

A large tree, tastefully decorated, occupied a prominent place in the front of the room. Behind, as well as on the tree, were the causes for anxiety.

A well-arranged program included sleight-of-hand (it's a shame the way the front rows were fooled), piano playing, singing, stereopticon slides, accompanied by appropriately selected parodies, and last, but not least, the presentations. Santa Claus remembered them all, but his gifts were accepted in the spirit in which they were given, so that the spirit of Yuletide prevailed.

Cider and pretzels were on hand in abundance at the close of the entertainment, and everybody enjoyed a social half hour talking it over.

THE CIVIL ENGINEERING DANCE.

The Civil Engineers have selected the evening of Friday, April 24, for their seventh annual dance. The committee, with J. B. Warrington, C. E., '14, as chairman, is already on the job and promises some new kinks at this year's affair. Those who have never as yet attended a C. E. dance are especially urged to come out and help make this function the very best that the Civils will have ever had. To the old reliables—well, they don't have to be told.

It is earnestly hoped, too, that the alumni will be out in

force. Several of the graduates have already signified their intention of being present.

The subscription price is the same as in past years, four dollars. This will include flowers—a novel scheme as well as an economical one. Make out your checks to John English, C. E., '14.

ELECTRICAL AND MECHANICAL ENGINEERING

"HUMAN ENGINEERING."

Bursts of applause followed the lecture on "Human Engineering" given by Mr. Willard Beahan, the First Assistant Engineer of the Lake Shore and Michigan Southern Railway. The lecture was given before the Junior and Senior Engineers on the 19th of December.

Even this subject of study has its laws. First, and most important of all, is the Golden Rule of Moses, and, second, the "square deal" of Roosevelt, which needs no comment. The others are very closely related to it. "Carry on your heart the men you carry on your payroll," and display personality, discipline and good treatment.

Every one knows that hard and fast rules can never apply to dealings with men, and that human engineering can never be reduced to a science, but surely there was no one who attended the lecture who was not inspired by Mr. Beahan's forcible talk and his most successful example.

ELECTRICAL ENGINEERING.

Dr. Robert H. Fernald lectured on the "Smoke Nuisance" at the Houston Club on Saturday, January 24.

Professor J. J. Morris has invented a multiple, single-lever air valve to displace the many valves formerly used on pneumatic moulding machines.

Robert H. Krewson, instructor in shop appliances, has been awarded first prize by the United States Navy for an electrical layout to be used in cruisers and passenger vessels.

Mitchell Bros., 212 Race street, have been awarded the contract for a three-story brick and plaster apartment house, to be erected at 413 South Sixty-third street, for C. W. Miller. A. B. Harding, M. E. '15, architect.

Whitney Society.

A meeting of the Whitney Engineering Society, followed by an interesting paper, was held on Friday evening, December 12th.

Reports of the Picture and Smoker Committees were presented, the latter showing a clearance of all expenses. Attention was also called to the new smoking-room rules. The President made a good suggestion to the effect that more interest and spirit would be displayed if the students themselves presented papers.

The meeting then adjourned to hear the speaker of the evening, Mr. D. S. Hilborn, one of our own men of '99, who has made his place in the Bell Telephone Company. His talk on "The Wheatstone Bridge as Applied to Telephone Testing" was of interest both from the technical viewpoint and from his description of the actual manner of carrying out the work.

The January meeting of the Whitney Engineering Society 27th, by Algernon Roberts Cheyney, Superintendent of Station A President and Secretary-Treasurer. An illustrated lecture was then given by Mr. W. A. Caster, of the United Gas Improvement Company, upon the manufacture of gas both by distillation and water processes. Refreshments followed the talk.

The February meeting will be addressed on Friday, February 27, by Algernon Roberts Cheyney, Superintendent of Station A of the Philadelphia Electric Company.

Mr. F. S. Balyeat, of the Westinghouse Electric and Manufacturing Company, addressed the Senior Electricals on the 13th of February. He described the electrical field and divided their apprentice school course into the six following departments:

1. Design.
2. Scientific Management.
3. Test.
4. Commercial.
5. Construction and Erection.
6. Operation.

Whitney Engineering Dance.

The Whitney Engineering Society will hold its eighth annual dance on Thursday evening, April 30th, in the Engineering Building. This is the pre-eminent social affair of the season for the Mechanical and Electrical Engineers, and is the time when the "get-together" spirit reaches its peak. S. H. Ouerbacker, the chairman, promises that this year the accommodations will be at least up to standard, and you know what that means. The success of the evening, however, depends on the attendance, and the attendance depends on you—and on her.

University of Pennsylvania

Founded 1740

The Towne Scientific School

COURSES IN

CIVIL ENGINEERING ELECTRICAL ENGINEERING

MECHANICAL ENGINEERING

CHEMISTRY AND CHEMICAL ENGINEERING AND ARCHITECTURE

For general information relating to the Towne Scientific School write to the Dean

JOHN FRAZER, PH.D.
Engineering Building, University of Pennsylvania, Philadelphia, Pa.

For special information relating to individual courses write as follows:

For the Chemistry and Chemical Engineering Courses

PROF. EDGAR F. SMITH
Harrison Laboratory of Chemistry, University of Pennsylvania
Philadelphia, Pa.

For the Course in Architecture

PROF. WARREN P. LAIRD
College Hall, University of Pennsylvania, Philadelphia, Pa.

For the Civil Engineering Course

PROF. EDGAR MARBURG
Engineering Building, University of Pennsylvania, Philadelphia, Pa.

For the Mechanical and Electrical Engineering Course

PROF. ROBERT H. FERNALD
Engineering Building, University of Pennsylvania, Philadelphia, Pa.

Journal of the Towne Scientific School Undergraduates

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CONTENTS

May, 1914

PROFESSOR EDGAR MARBURG . . . Frontispiece

FOREWORD 103
Professor Edgar Marburg

DESIGN OF A NEW COALING PIER . . . 104
J. E. Crawford, C. E. '97

VIEWS OF A NEW COALING PIER 108

THE VALUE OF A MILITARY TRAINING . . . 111
Spencer Roberts, E. E. '14

PORT DEVELOPMENT: A FIELD FOR THE ENGINEER . 112
Benjamin F. Cresson, '94

THE UNITED STATES LIGHTHOUSE SERVICE . . 116
J. S. Conway, C. E. '00

STUDENT DAYS IN PARIS 119
Grant Simon, Arch. '11

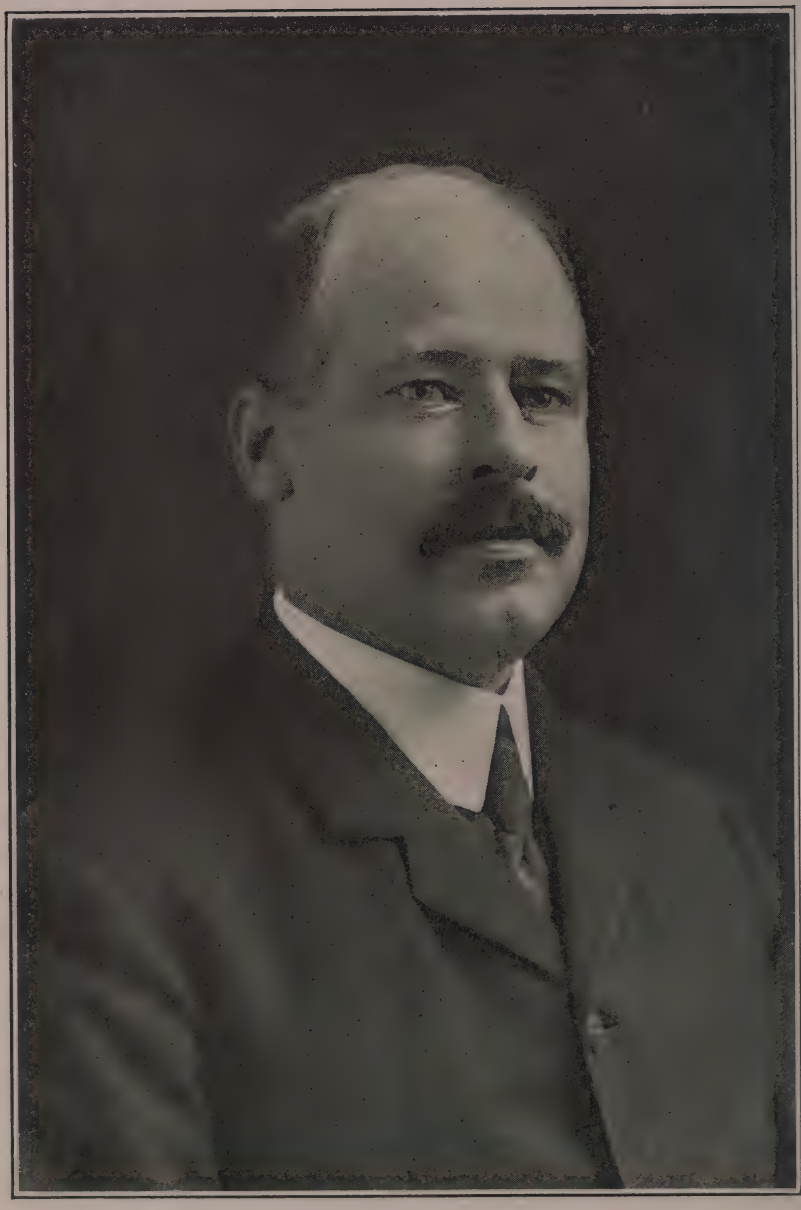
THE JOURNAL'S OFFICE 123

EDITORIAL 125

ALUMNI 131

NEWS 134

ADVERTISEMENTS 142



Professor Edgar Marburg

Journal of the Towne Scientific School

Vol. I MAY, 1914 No. 3

FOREWORD

The foreword to this, the third issue of the TOWNE SCIENTIFIC SCHOOL JOURNAL, well merits, as its own foreword, an expression of congratulation to its editors on the creditable initiation of their enterprise, which is, itself, the happiest augury of its permanence and growth.

In the establishment of the Towne Scientific School the University authorities recognized the essential unity of aim and purpose of its three divisions—Chemistry, Engineering and Architecture. It is especially fitting, therefore, that this mutuality of interests should have received like recognition at the hands of the student body, in the creation of a single undergraduate organ, designed to further these joint interests in a broad, generous University spirit. In order that the Towne Scientific School may achieve its highest destiny it should be jealously safeguarded, as every friend of the School will agree, against anything savoring of narrow departmental rivalry. Each department should be willing, nay anxious, to subordinate itself, if need be, to the common good; for it is as true of this, as of every human organization, that in unity lies strength. It is significant, and highly commendable, therefore, that the sponsors of the Whitney Engineering Magazine, the forerunner of this Journal, should have set so worthy an example in the direction indicated, by their own proposal of the expansion of scope implied in the designation of the present publication.

May the TOWNE SCIENTIFIC SCHOOL JOURNAL continue to receive, as it deserves, the loyal support of every well-wisher of the School, be he teacher, graduate or undergraduate!

EDGAR MARBURG.

THE DESIGN OF A NEW COALING PIER

By J. E. Crawford, C. E. "97.
Chief Engineer, Norfolk & Western Railway.

An important feature of the business of the Norfolk and Western Railway consists of transporting the well-known Pocahontas bituminous coal from the mines in West Virginia, a distance of about 400 miles, to Lambert's Point, in Norfolk harbor, and there delivering it to vessels for shipment to all parts of the world.

About 400 carloads, amounting to 20,000 tons per day, are now delivered to boats over the Norfolk and Western Railway Company piers at Lambert's Point. Time is an all-important feature in delivering this coal to vessels, since the difference of a few hours frequently enables a vessel to clear the harbor before dark, thereby saving a day, which, for the large vessels, means a saving of several hundred dollars per vessel at each coaling.

In order to meet the increasing demands for a large tonnage and the quickest possible delivery of this coal to vessels, a new coaling pier has just been built.

The problem of designing this pier was complicated, by reason of the requirement that it must deliver on a moment's notice any one of forty different kinds or classifications of coal to any kind or size of boat that might require it. Also, in order to allow time for trimming or leveling the coal between decks or in oddly placed bunkers, without delaying the whole operation of coaling, the coal must be delivered to five or six hatches of a boat at one time, and either rapidly or slowly, as required by the trimming. Furthermore, it must be delivered to four or five vessels simultaneously, and in such a manner as to reduce the breaking of the coal to a minimum.

Over fifty miles of yard tracks are provided for feeding the coal to these piers. The coal is delivered in solid trains to the receiving yard, which holds 3300 cars, where it is classified.

It is then pulled out in cuts of 34 cars, as needed, and pushed over a hump into the gravity yard holding 400 cars, which yard is on a one per cent. grade, upon which the cars run by gravity over the 200-ton capacity track scales, when they are automatically weighed, while the car is in motion.

The car then runs over a barney pit, where an electrically operated barney car follows in behind and pushes the car up a 12 per cent. grade about 200 feet long into one of the two electrically operated car dumpers. After being dumped, the road car returns by gravity to the empty yard. From this yard the empty cars are pulled out in solid trains direct to the coal fields.

The two dumpers are each capable of dumping from 36 to 38 cars an hour, and they will dump any capacity of car, from the smallest to the new 90-ton capacity cars now in use on the Northfolk and Western Railway. On entering the dumper the car is clamped to a movable platten, which revolves through an angle of 135°, dumping the coal into an electrically operated steel pier car having a capacity of 115 tons of coal. This pier car will therefore hold the coal from two of the ordinary 50-ton or 57-ton capacity road cars or one of the new 90-ton capacity road cars; the object of dumping the coal from the road cars into the pier cars being to save the labor and time required to unload a hopper-bottom car direct into pockets, as this method of unloading the road cars has proven slow and expensive, owing to the packing and freezing of the coal in the cars while in transit.

The pier car then runs, under its own electric power, into one of the two elevators, which raises it about 80 feet to the top of the pier, where it is dumped into one of the 64 pier hoppers. The bottom doors of the pier car are operated in two pairs by compressed air, so that one-half of the coal is dumped at a time. The coal runs very freely, practically the entire 50 tons falling in one mass. The pier car then returns to the dumper by a long inclined return track running from the outer end of the pier on a 6.25 per cent. grade to the dumper. The car is equipped with three braking systems—compressed air, dynamic and hand brakes, any one of which will hold it on the return-track grade. The dynamic brake is the one regularly used, since it automatically controls the speed without being so positive as to slip the wheels and flatten them, as is probable by either of the other systems.

The two electrically operated elevators run independently of each other, and each elevator is so counterweighted that it requires the same power to lower an empty elevator as to raise an elevator carrying a pier car, which weighs with its full load of

coal 165 tons. By this means the peak load at the power house is kept down to a minimum. Automatic cut-offs prevent the over-travel of the elevator, and near the top of its rise the elevator platform picks up one end of a 50-foot deck girder span, having its other end hinged to the fixed deck of the pier, and thus allowing for a variation of two feet in stopping the elevator. Each elevator can make a round trip every two minutes.

The 64 hoppers on the pier will each hold 115 tons of coal, or one pier carload. A great deal of care was expended on the design of these hoppers to secure one which would empty itself rapidly and completely. The ordinary form of rectangular hopper with flat slopes will not do this, on account of the valley or intersection of these slopes being flatter than the slope of the balance of the bottom. The hopper bottoms as built have the same slope at all points, being in effect an inverted semi-cone.

The coal from the hoppers flows into a vertical chute 4 ft. square, and down this chute to an adjustable chute box, to which is attached, by a hinged joint, the inclined chute which feeds the coal into the hatch of the vessel. This chute box can be raised or lowered so that the end of the inclined chute, which can be kept at a uniform slope of about 8 in. vertical to 12 in. horizontal, will feed the coal into any hatch from that of the lowest barges 5 ft. above the water to that of the largest boats, 47 ft. above the water.

There are two gates operated from the top deck of the pier, which control the flow of the coal from each hopper—one gate at the bottom of the hopper and one at the chute box. The adjusting of the chute box, chutes and gates is all handled from the top deck of the pier by hand winches having differential counterweights to reduce to a minimum the power required for their operation.

The pier is 1200 ft. long and 90 ft. high above high water. The hoppers are spaced 30 ft. apart, so that on each side of the pier there are 32 chutes, 30 ft. apart, for delivering the coal to vessels. Each vessel can be coaled from as many chutes as desired and at any desired rate.

Economy in the cost of the steel pier superstructure and sub-structure was secured by reducing the number of columns and cylinder piers by developing the longitudinal and transverse

bracing into a system of trusses. These trusses carry the pockets between the towers and the return track as it descends through the centre of the pier. The columns are so located under the cross girder as to balance the stresses in this cross girder.

Forty cylinder piers 18 ft. in diameter, which carry the pier superstructure, are each supported by 65 Virginia-pine piles, driven so that their points are from 60 ft. to 90 ft. below the surface of the water. In order to avoid the expense of procuring piles of such great length and to secure a pile of larger diameter, 65 piles, 30 ft. to 60 ft. in length, were driven in a close group before the cylinder was set. By using a pile driver with a follower, in telescopic leads, the piles were held true to position and were driven until their tops were about 30 ft. below the water and 5 or 6 ft. above the mud line. Each pile carries about 18 tons. A water jet was used first on the location of each pile, in order to make a hole for it in the gravel bottom, so as to secure as great a penetration as possible. The 18-ft. cylinder, 34 ft. long, having a 7-ft. temporary top section, was then set over these piles and hung from the timber pier protection; five feet of concrete was then placed around the tops of the piles by a drop-bottom bucket of one yard capacity, which deposited the concrete under the water. The object of this concrete is to seal the cylinder against 38 ft. of water pressure. After this sealing concrete had set about a week the cylinder was pumped out and the pier completed in the dry. The slips adjacent to the pier, having an area of about 20 acres, were dredged to a depth of 32 ft. by a large suction dredge, which pumped the material through a 22-in. pipe and deposited it behind bulkheads over a large area upon which the yard tracks were built.

One of the views (Fig. 1) shown is taken from the top of the elevators. It shows the storage yard in the right background, the gravity yard in the centre background, and the empty yard on the left side with an empty car just running down into it. The transformer station and the two automatic track scales are shown in the centre, two loaded cars having just passed over these scales, running by gravity to the barney, which will push them up into one of the dumpers which are shown in the foreground. The two dumpers are shown with the pier cars placed ready to receive the coal. One dumper holds a car just ready

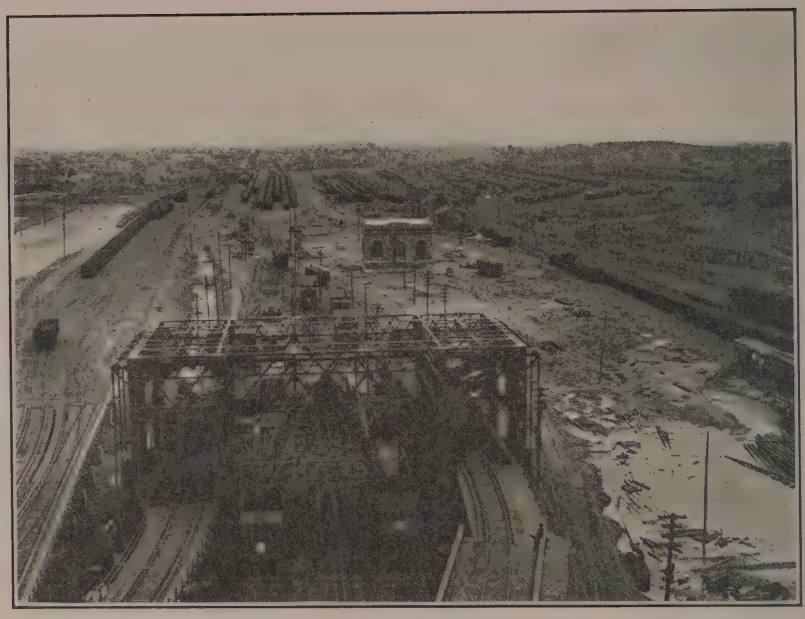


FIGURE 1

FIGURE 2

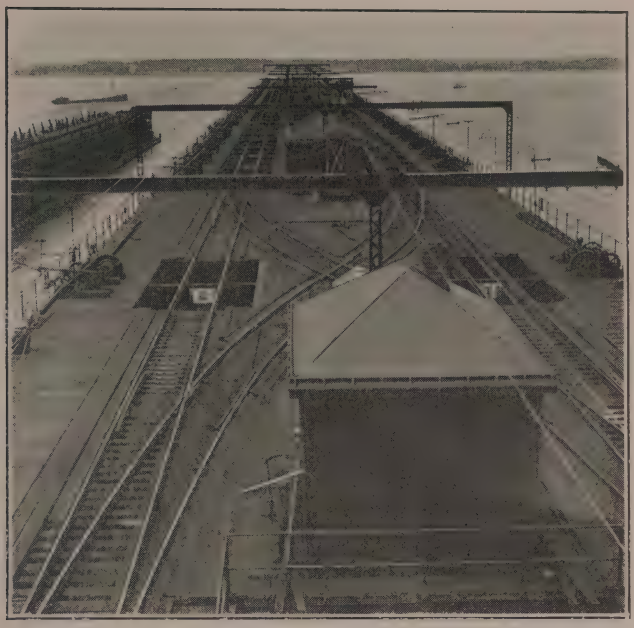


FIGURE 3

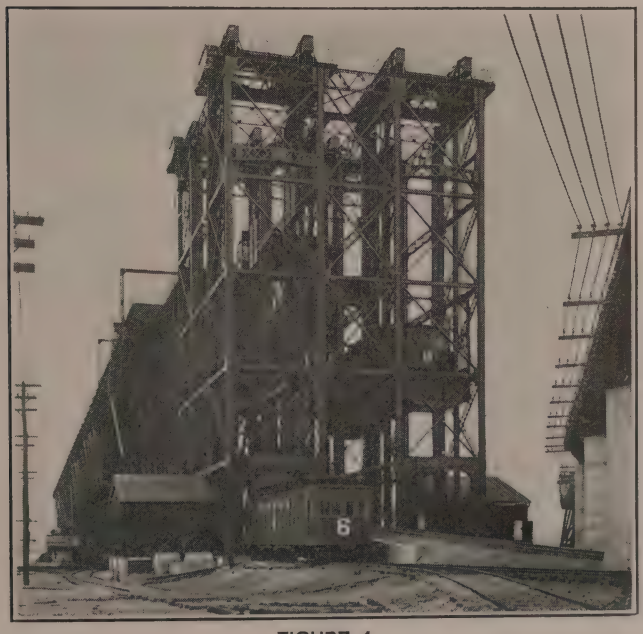


FIGURE 4

to be dumped, and one dumper has the car turned about half way over.

The second view (Fig. 2) shows the U. S. Naval Colliers "Jason" and "Orion" at the pier. The latter received 10,500 tons of coal, or about 230 car loads, in seven hours.

The third view (Fig. 3) shows the top deck of the pier with its 64 pockets and the winches for operating the gates and chutes.

Another view (Fig. 4) shows the elevators. One elevator is just receiving the loaded pier car, while the other has raised its pier car about half way to the top deck of the pier.

The Norfolk and Western Railway now has in service in the Norfolk coal trade cars of 90 tons capacity in connection with this new coaling pier. This is the largest capacity car in regular service on any road or in any country. Each of these cars, with the permissible ten per cent. overload, will carry 100 tons of coal, and they have carried as high as 103 tons per car. The present 57-ton capacity coal cars have an axle load of about 43,000 lbs., and the frequent repetitions of stress produced by trains of these cars on the steel rails, with the consequent wear and flowing of the steel, indicated that these axle loads should not be increased. The new 90-ton cars have therefore been built with three axle trucks, so that the load per axle is held to 43,000 lbs. These trucks have articulated cast-steel frames, and have proven very satisfactory.

These 90-ton capacity cars result in a substantial economy of operation in addition to the economy secured by the increased speed of coaling, as is shown by the following data obtained from a large number of cars as actually weighed in service:

Comparing them with the 57-ton capacity hopper cars, we find the percentage of revenue load to total load is increased 5 per cent. We find the length of a 5000-ton train is reduced from 2325 feet to 1960 feet, the number of cars being reduced from 70 to 40, and the number of couplers, air-brake units, air hose, brake shoes and other wearing parts, being correspondingly reduced. Finally, we find that the cost of the rolling stock of the train is reduced from $20.50 to $17.37 per ton of revenue load.

This equipment has dumped 66 cars an hour, using both dumpers, or 36 cars an hour, using one dumper.

The maximum capacity of this pier is about seventy 57-ton cars, equal to about 3500 tons per hour, or sixty 90-ton cars, equal to about 5400 tons per hour. Any part or all of this coal may be delivered to one vessel.

The pier has been in operation for about three months, during the greater part of which time the machines have been under adjustment and the operators have been learning the machines, so that no attempt has been made to run at full capacity.

I quote, however, some remarks of Captain Thomas, of the British steamer "Wimbourne." This is a modern steamer, which took on 9000 tons of coal from the new pier in about six hours of coaling. Speaking of the performance, Captain Thomas said: "If there is any port in the world that can beat this, I have not seen it," and added, "There is not a spot in the world, in my opinion, that can touch it."

Finally, it has been proven that the method of handling the coal over this new pier by always keeping it flowing from the dumper and pier cars in a large volume and by keeping the vertical chute full of coal, has reduced the breaking of the coal materially.

THE VALUE OF A MILITARY TRAINING

SPENCER ROBERTS, 3RD, E. E., 1914.

It has long been generally recognized that the study and practice of military science in all its branches is the finest training in discipline and self-restraint. Many American institutions have already adopted such courses, and those who as yet have not, are considering such a move. There are a number of opportunities for men desiring such knowledge in the several Regular Army Summer Camps for college men and in the many State and local military organizations in our cities. In these one not only obtains a knowledge of the manual of arms and drill regulations, but an acquaintance with military requisites, policies and history. All of these are essential to the fit American citizen. If one is a technical man, there are the Engineer and the Signal Corps; if a

medical student, the Hospital Corps; if at home on a horse, there are the cavalry organizations. The infantry and artillery offer opportunities for the straight soldier, while the summer naval schools on the cruisers and battleships are for the college man who inclines toward the sea.

There a thorough insight into the oldest yet the most up to date of sciences can be obtained. One sees how very large bodies of men are organized, trained, fed, clothed, transported and managed. Such knowledge is invaluable from a straight military standpoint, for it enhances the present insufficient reserve forces of our great American nation. The main purpose, however, is not to exalt the military, but rather to provide a nucleus around which to build should it ever become necessary, and this necessity is not so obscure as many believe. A patriotic spirit is also augmented, and this in itself is a great feature.

Summer camps and manoeuvres are beneficial in a physical way, for there healthful outdoor life is possible and the broadening influences are ever prevalent, as one meets men of all types and personalities. From a commercial standpoint such experiences cannot be placed at any small value. Increased economic efficiency is gained through habits of discipline, self-control, obedience, command and order and "a knowledge of the organization and administration of first-class modern armies is applicable in many lines."

PORT DEVELOPMENT: A FIELD FOR THE ENGINEER

By BENJAMIN F. CRESSON, '94
Chief Engineer, New Jersey Harbor Commission,
Jersey City, N. J.

One of the great necessities in the march of modern civilization is the growth and improvement of transportation facilities. Industries are located as a rule where they can get their raw materials cheapest, and where they can send their finished products to the market with the least cost and delay. Population follows industry, and the prosperity of a country or a community is largely controlled by the quality of transportation that it can offer.

The growth of the railroads in this country has been phenomenal. They are being extended and improved as the demand for opening up new territory occurs, and as the necessity presents itself for meeting new conditions of competition and business.

The value of a railroad to a community is measured by the economic use the community can make of it. Without sidings for industries, and without freight and passenger stations it is useless to a community, and is a detriment and a handicap. Where the terminal arrangements are best, the communities profit the most. This is true of water transportation systems as well as of railroads; canals without terminals are valueless, and the physical advantages which a harbor may possess can be largely nullified by the lack of proper facilities for interchange of freight between land and water carriers.

The strength of a chain is limited by its weakest link, and it is quite generally recognized that in the railroad systems, in this country at least, the terminals are the weak parts.

The terminal costs are a large part of railroad operating expenses, and these costs must be divided over a great mileage of cheap transportation in order to show a balance on the right side. It has been stated on good authority that in shipping freight between New York and Chicago the cost at the terminals is as great as the cost of transportation between them.

It is also true that terminal costs are unduly high at seaports where interchange of cargo is made between land and water carriers.

The subject of port development, which involves ownership and administration as well as physical construction, is one that now is much under consideration, particularly in this country. The creation and control of facilities for the interchange of freight between land and water carriers, with the least expense and the greatest freedom in reaching all the carriers, presents a great field for the engineer.

The opening of the Panama Canal will create new conditions and opportunities for trade, and there is practically no seaport of importance in North America which is not planning to increase its facilities in order to reap some of the benefits that will come as a result.

The policy of public ownership and control of seaports, which has been recognized and adopted in most of the older European ports, is gradually getting a foothold in this country and it seems likely that other ports will follow the lead of Montreal, New Orleans and San Francisco in making their harbors under public administration.

Waterways are public highways just as much as are public roads and streets, and about the only way monopolies in water transportation can be effected is by monopolizing, under private control, the waterfront at important ports.

Laws have been enacted in certain States looking toward public control over the development of harbors: Pennsylvania, through its Department of Wharves, Docks and Ferries and its Commissioners of Navigation, exercises control over private as well as public development on navigable waters throughout the State. Massachusetts, through its Board of Harbor and Land Commissioners, and its Directors of the Port of Boston, has about the same powers. The State of Louisiana and the City of New Orleans control and operate, as well as own, a large part of the port of New Orleans, and this includes not only the docks and warehouses, but also the belt-line railroad. California, through its Board of State Harbor Commissioners, owns and controls practically all of the most desirable waterfront of the harbor of San Francisco. The State of Washington has laws which permitted the organization of the Port of Seattle Commission, and there are many other instances indicating the adoption of the policy of State control.

The State of New Jersey appointed a commission in 1911 to investigate the subject, and after three years' study this Commission presented a report with recommendations for a State policy. As a result of this, the New Jersey Legislature, at the last session, passed a law creating a permanent harbor commission with power to approve or disapprove all plans for waterfront developments, and in addition making it the duty of this commission to assist municipalities throughout the State in the preparation of plans, and in any dealings which they may have with the Federal Government in their requests for the adoption of favorable harbor lines, and in the creation of necessary channels by dredging at the expense of the Government.

Vast sums of money have been spent in order to provide facilities to encourage commerce, recognizing that commerce is of the greatest importance to the growth of a country; as instances, London has spent more than one hundred and thirty-five million dollars on its docks and harbor facilities; Liverpool more than one hundred and fifty million dollars; Hamburg more than eighty million dollars; Antwerp more than forty-five million dollars; Sydney, New South Wales, more than thirty million dollars; Calcutta nearly forty million dollars, and Bombay more than thirty-five million dollars.

Where private interests develop the harbors and create facilities for the interchange of commerce they naturally hope to get a profit from their operation, but the prosperity of the community does not depend upon the toll which is taken from commerce as it passes the docks. The harbors are not the places for private profit; they should be controlled by the public in order that the passage of commerce may be as cheap and free as possible and in order that the "hinterland" may profit by the industries which commerce brings.

It should be the effort at all seaports to bring to tidewater the lines of as many railroad systems as possible, and to have radiating from the waterfront as many great water transportation systems as possible. The port with the greatest number of railroads and with the greatest number of steamship lines with regular sailings to the greatest number of ports will be the most sought after port to do business in; and every effort should be made to make the interchange of freight between carriers as cheap and easy as possible. It is the movement of trains on regular schedules carrying freight to all parts of the country, and the regular sailing of ships to ports throughout the world, which lead the manufacturer to send his mixed cargo to the port so equipped, for from this port he can be assured that his product will promptly move on to its various points of destination.

There is a great contrast between American and foreign ports in their equipment of cargo-handling appliances. Elaborate systems of cranes, gantrys, etc., exist throughout the ports of Hamburg, Antwerp, Liverpool and London, while in this country there is very little machinery in operation except for the handling

of bulk cargo. Developments can, no doubt, be made along these lines, and the transportation companies are looking forward to the application of freight-handling machinery to decrease the present high cost of handling freight, and to permit a more economic use of the waterfront.

The effect of cheaper transportation will be felt by every community and by every person, and the engineer who plays a part in laying out and developing better terminals than now exist will aid greatly in the progress of civilization.

THE UNITED STATES LIGHTHOUSE SERVICE

By J. S. CONWAY, C. E. '00
U. S. Deputy Commissioner of Lighthouses.

The first lighthouse on this continent was built in 1715-16, at the entrance to Boston Harbor, by the Province of Massachusetts, and was supported by light dues on all incoming and outgoing vessels, except coasters. Several other lighthouses were built by the colonies. Congress, by the act of August 7, 1789, authorized the maintenance of lighthouses and other aids to navigation at the expense of the United States. There were at that date eight lights in operation, maintained by the colonies. These, together with others completed later, thirteen in all, were ceded to the General Government by the States.

The maintenance of lighthouses, buoys, etc., was placed under the Treasury Department, and up to 1820 was directed personally by the Secretary of the Treasury, except for two intervals, when supervision was assigned by him to the Commissioner of Revenue. In 1820 the superintendence of the lights devolved upon the Fifth Auditor of the Treasury, who was popularly known as the General Superintendent of Lights, and who continued in charge thereof until 1852, when the United States Lighthouse Board, consisting of officers of the Navy and Army, and civilians, was organized, with the Secretary of the Treasury as *ex-officio* president of the Board. The Board selected from its own number a member to act as chairman.

The Lighthouse Service was transferred to the Department of Commerce on July 1, 1903. On July 1, 1910, the Lighthouse

Board was terminated, and the present Bureau of Lighthouses established. In this Bureau the Commissioner of Lighthouses and his principal assistants are appointed by the President.

The United States Lighthouse Service is charged with the establishment and maintenance of aids to navigation, with all equipment and work incident thereto, on the sea and lake coasts of the United States, on the rivers of the United States, and on the coasts of all other territory under the jurisdiction of the United States, with the exception of the Philippine Islands and Panama. The jurisdiction of the Lighthouse Service over rivers not included in tidewater navigation is restricted to such as are specifically authorized by law; these now include practically all the important navigable rivers and lakes of the country.

All the work of establishing and maintaining the aids to navigation under the jurisdiction of the Lighthouse Service is performed directly by that Service through the district organizations, with the exception of a few minor aids which are maintained by contract, and with the exception of the Island of Guam, the American Samoan Islands, and Gantanamo Bay, Cuba, where the aids are maintained through the local authorities. The Lighthouse Service also has supervision over the establishment and maintenance of private aids to navigation.

There is an office in Washington, which is the executive centre of the Service, under the Commissioner of Lighthouses. There are in this office an engineering construction division, under the Chief Constructing Engineer; a naval construction division; a hydrographic division, and the general office force.

The Service outside of Washington is divided into nineteen lighthouse districts, each of which is under the charge of a lighthouse inspector. In each district there is a central office at a location selected on account of either its maritime importance or its geographical position, and there are also one or more lighthouse depots located conveniently for carrying on the work of the district, in the matter of storing and distributing supplies and apparatus. Each district is provided with one or more lighthouse tenders for the purpose of distributing supplies to the various stations and light vessels and for transportation of materials for construction or repair, for the placing and care of the buoyage system in the district, and for transporting the inspector and

other officers of the Service on official inspections of stations and vessels and on other official duty.

In addition to the various district depots, there is in the Third lighthouse district, on Staten Island, New York Harbor, a general lighthouse depot, where many of the supplies for the whole Service are purchased and stored and sent out for distribution, and where much of the special apparatus of the Service is manufactured or repaired, and where also there is carried on various technical work in the way of testing apparatus and supplies and designing or improving apparatus.

During the fiscal year 1913 there were 44 regular lighthouse tenders in commission, and the Service maintained light vessels at 53 stations; having for this purpose 67 light vessels, of which 14 were relief vessels, making a total of 111 vessels. The number of employees was 5536, and the number and classes of aids to navigation maintained by the Service were as follows:

Lighted aids:	
Lights (other than minor lights)	1,531
Minor lights	2,666
Light-vessel stations	53
Gas buoys	388
Float lights	101
Total	4,739
Unlighted aids:	
Fog signals	520
Submarine signals	46
Whistling buoys, unlighted	84
Bell buoys, unlighted	216
Other buoys	6,174
Day beacons	1,655
Total	8,695
Grand total	13,434

The number of private aids to navigation maintained was 622.

The appropriations made by Congress for the general main-

tenance of the Lighthouse Service for the fiscal year 1914 amount to $5,071,930; the appropriations made for special works are $722,600. Such special works include new lighthouses, fog signals, light vessels and depots, and extensive improvements or rebuilding of these.

The most noteworthy example of construction accomplished during the last fiscal year was the construction of foundations for ten beacon lights marking the Livingstone Channel, Detroit River, Mich. The concrete foundations of six of the beacons lights were constructed in place in the cofferdam built by the United States Engineer officers for the purpose of taking out the principal rock cut, thus avoiding the heavy expense which would have been incurred had it been necessary to place these foundations under water. The remaining four foundations, to be located farther down the river, were constructed by building re-inforced concrete cribs at a selected point within the cofferdam, afterwards towing them downstream to their proper positions, sinking them by means of sluice valves provided for the purpose, then pumping out the water from the interior of the cribs and filling them with concrete. This has also proven to be an economical method of construction. Iron ice guards around the water line were provided for the concrete foundations. Acetylene illumination was provided for the beacon lights.

The present Commissioner of Lighthouses is Mr. George R. Putnam, M. Am. Soc. C. E., the writer is Deputy Commissioner, and Mr. Horatio B. Bowerman, M. Am. Soc. C. E., is Chief Constructing Engineer.

STUDENT DAYS IN PARIS

GRANT M. SIMON, Arch. M. S., '11
Eleve de M. Bernier.

Attention! Attention! prenez garde. That busy little street, the Rue Bonaparte, has put aside its thrifty commercialism and is making way for a crowd of boisterous and yelling students. They are pushing a cart filled with mounted drawings. Yes, pushing, hauling, cursing, dancing and with all singing snatches of symphony.

"It has just arrived!" It is the "rendu," and they have only five minutes in which to reach the school before the gates are closed.

They must make it. To be late for the rendu, is, to the architectural student of the school, the height of despair. Certainly they will do it. Other men have now joined the group, and with a last desperate rush they wheel into the courtyard. Now it is bedlam, for here are other carts arriving in equal haste. These beings on two legs have long ceased to be students—they are animals, fanatics, maniacs, a wild struggle of primitive forces. The gate clangs behind the last cart. No, it is not the taking of the Bastile, nor has a Cabinet resigned; the question that has turned these otherwise gentlemen into a discordant mob is simply one of "parti."

And the question of the "parti" is at that particular moment shaking the very foundations of what was once the "Quartier Latin." The "parti," may I add, is not the one familiar to men of the American universities. It is approached with equal, or even greater enthusiasm. More time is devoted to it. Further, the results are not attained by such artificial means as in this country—yet, every man has his own particular "parti," which he guards with the care of a doting parent. This is one way in which it differs from its American counterpart.

Again—the American "parti" is, or should be, spontaneous, while unfortunately the "parti" dear to the heart of every student of the school is usually found after hours upon hours of laborious study. Hours spent in a "loge," a closet, close, humid and cold in winter, the night hours illumined by a lonely, flickering candlelight, and dimned by the wild rollicking songs of a hundred unfortunates. Truly these men must have an inner vision. Can you picture the average American spending from twelve to twenty-four consecutive hours in such quarters, and working every minute of each hour? No, you cannot. It is enthusiasm, realized——(?)

The noisy mob is breaking into the component parts, the various ateliers. Once more the court resumes its scholarly languor, broken occasionally by the far-echoing disputations. Not for a week, or perhaps two, will the eminent architects composing the jury decide the competition. For these concours are

decided very much like a horse show; given a certain number of entries in one class, the entry having the greatest number of points wins. The principal difference is that the contest is fair.

To the fortunate man who is placed first, whose "parti" or abstract analysis of the problem is most pleasing—to him; all honours.

The dawn breaks over the mysterious, incomprehensible French night of charettes, chaussers and rendus, and the winter of the concours, held in even greater esteem than a wearer of the "P," gives a party. But why describe the horrible details? Pascal, Bernier, Laloux, whichever atelier it is, now is the popular idol.

O night of nights! O wild sweet blue! Picture the concentrated enthusiasm of a season's football game in twenty men with a two-weeks' vacation and a victory to celebrate. Paris—a "prix" (prize) in the Chenavard, and nothing ever closes. Even work in a "loge" has its compensations!

But the rest is well earned. For months these men have worked, and really worked. In Wharton or Arts, a sixteen-hour week is boasted of—a gigantic undertaking—a good excuse for an extra remittance from home. In the Ecole des Beaux Arts, it is a fair day's work toward the end of a "charette."

"The School" is essentially different from the American university. First, it takes the usual college graduate almost a year before he is prepared to enter the school. This time is spent as a "nouveau" in one of the many ateliers. Practically all of the work required by the school is done outside. Each atelier has a "patron," some well-known Parisian architect. Twice a week the patron descends to the atelier—or rather ascends, for they are almost invariably on the sixth or seventh floor of some dilapidated house. He spends perhaps an hour, seldom more than three, in criticising the work. A man is placed therefore entirely on his own initiative. Cuts, latenesses and suspensions are unknown. It is assumed that a man entering the school desires to work—if he does not so choose, no matter—a very pleasant philosophy and a good one.

The attitude of the men towards their "patron" is somewhat different from the attitude of an American student to his professor, and perhaps with reason. When the "patron" enters

the filthy, disheveled, dusty barn, his atelier, the din, which has just been making the glass rattle and the very beams quiver, ceases.

A short man, with a slight stoop, immaculate in afternoon clothes—the red ribbon of the Legion d'Honneur in his buttonhole—enters. The room murmurs, "m'sieu," and resumes its work. A nouveau takes his top hat, his stick and gloves—and gently, reverently places them on a grimy peg, under which is marked in large letters: PATRON. Woe to the poor novice who by mischance hangs his hat on this hook. Not the least of the penalties is to be painted in stripes and then reclothed to a limited extent—the unclothed parts covered with chicken feathers or any other convenient material. There is no appeal.

The "patron," in a few terse words—not unkindly analyses the various "projects," correcting here, approving there, perhaps accompanying his remarks by quick diagramatic drawings. And then is gone.

But—as in each atelier there are men in every class from the nouveau preparing to enter to the men competing for the Prix de Rome. So is developed an "esprit de corps"; the men who are well advanced help those not so fortunate and in returning the nouveaux work on the large projets. Incidentally, a year's service as a "noveau" is the original method of placing a man where he sees exactly his own stature and no more. Among other duties the nouveau runs for more cigarettes, tobacco, food, paper, etc., when told to do so. Perhaps he has just climbed five flights of stairs, returning with a box of matches, when some one discovers that he wants two cigarettes. It is possible, you know, to buy two cigarettes here at once. The nouveau starts again—and so on—it is good exercise, and there is no "come-back."

The ateliers are organized with a "massier," a "sous-massier," and other officials corresponding to the president, vice president, etc., of an ordinary assembly. They are not secret societies in any sense of the word, but the men in each atelier preserve very jealously the individuality of their own atelier. Some of these are very old. My own M. Bornier's is one of the few school ateliers, so-called, because they have an apartment in the school. It has existed with about six patrons for nearly two hundred years.

The greatest known honour to befall an atelier is to win the

Photo by W. G. Mann

THE JOURNAL'S OFFICE

"Grand Prix de Rome." This is awarded every year. There are a number of preliminary concours—the final concour is a veritable "tour de force." The combined area of the drawings required of each man averages from five to six hundred square feet.

Naturally, the rivalry between the ateliers is very keen, it is the same story—every effort is made to have as many men as possible in the finals. This contest, in fact, all the special prize contests, are not open to Americans nor to any one excepting native Frenchmen.

But, aside from all this, Paris is not a bad place in which to study. There are drawing classes at Julien's—La Grande Chaumiere, lecture classes at the school, and at the Sorbonne, etc., etc. Again, life in the school proper is but a small part of the education which Paris, like a generous mother, gives—whether or no.

The Seine still flows in its silent course, L. Abbage's has not closed, nor has the Pantheon or d'Harcourt's.

American tourists still marvel at the Louvre, and leaving are most impressed by the fact that there are either seven or twenty-seven miles of galleries, they are not sure which; and does not Mona Lisa look the same, notwithstanding her journey?

You can still get a good steak at L. Fouquets, and a friend tells me that at the Tour d'Argent they are cooking Canard No. 38492. The authorities still censor the show at the Moulin Rouge. A man rode a bicycle through the galleries of the exhibition of "Les Independents." I don't blame him. I walked through, but just curiously. I wonder exactly with what form of pariesis is a cubist affected.

The Salon d'Hiver was very much of a failure—owing principally to the fact that there was an agricultural exhibition on the ground floor of the Grand Palais. You can't really enjoy a marine scape with five hundred roosters crowing—neither does a nude appeal very strongly when five hundred hens are cackling at once.

Mme. Bernhardt is playing in Jean D'Arc; very probably she will soon be in America on a farewell tour. Wonderful women: Women, women, women—la raison d'etre de Paris—from the time when the Parisienes sought refuge on the Ile de la Cite—even until the day when the city shall be a ruin. What a wonderful ruin it will make! But no matter, there will still be presumptious American guides in front of the remains of Cook's agencies.

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University of Pennsylvania

(WHITNEY MAGAZINE)

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EDITORIAL

Retrospect

The May issue completes the first year of the Journal's life, although its fourth year as a publication. In the final analysis of our progress we feel that it has been a successful one. The expansion into the architectural, civil engineering and chemistry departments; the addition of an extra issue; the possession of a finely equipped and furnished office, and the remodeled staff, have all augmented our scope and possibilities, and have aided in the firmer estab-

lishment of our magazine among University journals. Now that we hold our own in Pennsylvania, let us aim to set the pace in the intercollegiate world and may our past be meagre when judged with what is to be.

The Future

The future offers numerous opportunities. There are many new features which should be injected into the body of the Journal; the standard of material and composition can still be raised, and a greater efficiency in its management can be attained. There is also an increased percentage of alumni, faculty and undergraduate subscriptions possible, and our advertisements should commence on another peak. Where progression is lacking, retrogression exists.

Looking Forward

With the close of another school year we find the architectural department at almost the height of glory.

The Rome Prize, the largest competition in America, will be won by a Pennsylvania man as only Pennsylvania men have survived the first preliminary. The Paris Prize finals will soon start with more Pennsylvania men competing than any other school. The Interscholastic was won by Pennsylvania students with more points than all other colleges combined. The Stewardson is drawing near to the end and only students of Professor Cret will be in the final judgment.

The showing in these numerous competitions has placed Pennsylvania's architectural department in a position of supremacy never before attained—a position which must be maintained.

The fame of the architectural department through the coming years rests in the hands of the present undergraduates. A conscientious application of your energy to your non-architectural subjects in your first years will give you more time for design in the upper classes, and will be an example worthy of notice by the underclass men.

The Summer Job.

With the advent of spring or even during the winter months there comes the vision of a summer job. Nearly every

"engineer" from the Freshman up desires to obtain some sort of a situation with an engineering firm.

With some this is an easy task, while others experience difficulty in placing themselves. The field is a wide and varied one. The drafting-room is a rendezvous for many, although the compensation is usually low unless one has had some previous experience. This may be termed the vital department of many concerns, for there it is that ideas arise and are developed. One learns many short cuts in drawing and obtains an insight into the various phases of designing.

The shop has its attractions. Here one must work ten hours a day. The embryo engineer comes in contact with the hard-headed, practical mechanic, and sees the practical end of construction.

In the office there is often room for the vacation man, and here is gained knowledge of the business end. The purchasing and selling departments are worthy of study and a little experience in the stock room, testing and shipping departments, is of great value.

A knowledge of the "trade," both local and general, is of great future use, as are the acquaintances and friends which one makes.

It is needless to remark that any little conceit or personal esteem one may possess is quickly disseminated.

Several months spent in this manner will prove to be a period of great value, and then, too, a snug little bank deposit adds pleasantly to one's reminiscences of vacation time.

The Markings of a Man

The small skull, retreating forehead, the large jaw, outstanding ears, abundant hair, sparse beard, broad cheek bones, sclerosis, the epactal bone, asymmetry, exaggeration of the frontal sinus and the superciliary arches, oxicephaly, the open internasal suture, anomalous teeth, and asymmetries of the face, point out the criminal to the criminal anthropologist.

Your features betray your character to the world at large in just as definite a manner. A quick temper often giving way to anger rapidly distorts the facial expression, even more than worry mars the brow and deforms the mouth. Egotism, pride

and vanity show upon your features and in your actions as plainly as unkept clothes betray your slovenliness. Despair, pessimism, self-contempt and self-pity are evidenced by the shifting, unsteady eye and drooping mouth as clearly as envy, hate and grudge manifest themselves in moments of forgetfulness.

The neat appearing man, with the firm grasp of the hand, smiling countenance and unwavering eye, has the markings of a man which are bound to land him high in the esteem of men.

A Gentleman

Are you a gentleman? Read Professor Leeber's definition and decide for yourself.

"The word gentleman signifies that charter, which is distinguished by strict honor, self-possession, forbearance, generous as well as refined feelings, and polished deportment, a character to which all manners, explosive irritability and peevish fretfulness are alien, to which, consequently, a generous candor, scrupulous veracity and essential truthfulness, courage, both moral and physical, dignity and self-respect, liberality in thought, argument and conduct, are habitual, and have become natural. It implies also refinement of feelings and loftiness of conduct to the dictates of morality and the precepts of religion."

Perhaps Professor Leeber's requirements are too high. Can you qualify as a gentleman under Sir Philip Sidney's definition of a single line? "High thoughts seated in a Heart of Courtesy."

Tact and Courtesy

Many men do not seem to possess any idea of the true meaning of tact. They are too ready to blurt out whatever comes uppermost in their minds. Some believe in what they think is frankness, but which is, however, invariably bluntness. The sharp, shrewd man will quickly surpass the men of loose bearing who never seem to use their wits.

Courtesy is another feature overlooked by some. This is often due to thoughtlessness, but the man who always respects the feelings of others and never offends them, no matter what

may be their race or station in life, will have himself immediately respected. Whether it be in a lecture, "on the job," or at any other time, this holds. A little thought given to ethics will save many transgressions.

Be quiet, be affable, be enthusiastic, but always at the right time.

Unity

What the undergraduates of the engineering schools need is more unity of thought and action. Unity with all departments and unity with the School of Architecture. There should be a general Towne Society with the various subsidiary societies or branches. There should be more mingling; and there should be no "civil end," no "mechanical and electrical end." With hearty co-operation from all points, more social affairs could be staged; more dances for all; more smokers for all; a play for all; a Christmas Party for all; a better patronized banquet; and bigger men to talk at society meetings. Each class in each department should have an elected leader—the Freshmen especially. We are missing lots of things and the social life is a broadening life.

Advice

It has been said that one of the worst vices is giving advice. Advice is, however, valuable if given sincerely and in the right channel. Many men in the engineering schools could save their younger brothers, friends and acquaintances from selecting courses of which they know practically nothing and with whose future fields they are entirely unacquainted. A few good sound pointers would save many men who will later be misfits. Let them know the requisites and seek out their weak spots. Advice of this sort would decrease materially the number of "flunk outs," and if men seem lacking in the high points, recommend some other vocation.

This number of the TOWNE SCIENTIFIC SCHOOL MAGAZINE contains articles by three former students of the Department of Civil Engineering who received degrees, as of the respective classes to which they were attached, at the University Council

last December. The contributors in question are: Mr. John S. Conway, '00, Deputy Commissioner of Lighthouses, Lighthouse Service, Washington, D. C.; Mr. Joseph E. Crawford, '97, Chief Engineer, Norfolk and Western Railway, Roanoke, Va., and Mr. Benjamin F. Cresson, '94, Engineer, New Jersey Harbor Commission, Jersey City, N. J.

The following have been elected to manage the Journal for 1915:

Editor-in-Chief—Coleman Sellers, 3rd, M. E. '15.
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Civil Engineering—M. Duncan, C. E. '15.
Electrical Engineering—C. M. Doolittle, E. E. '15.
Mechnical Engineering—R. B. Ferris, M. E. '17.

ARCHITECTURE.

Mr. James Smythe Warner, M. S. '06, instructor in Freehand Drawing, underwent an operation for appendicitis April 27. We sincerely hope that he will soon be able to be with us again.

Albert Simons, M. S. '12, informed us, when he called last week, that he had accepted a position with the Roland Park Company, Roland Park, Baltimore.

Melvin P. Spaulding, B. S. '12, kindly permitted his sketches, made abroad, to be hung in the Library last week. The work, on account of its clever execution, was very instructive, and it is to be hoped that others upon their return will be as considerate of the men unable to go abroad.

Mark Lansburg, B. S. '13, came up from Washington to watch Pennsylvania in the Relays, and incidentally familiarize himself with architecture.

Charles Bensman, '12, with Tracy & Swartnet, of New York, was in Philadelphia for the Relays. Charles comes frequently and is never alone at the games.

CIVIL ENGINEERING

S. R. Campbell, B. S. (C.) '83, is Editor of the "American Gas Light Journal," New York, N. Y.

G. Sergeant, B. S. (C.) '84, is Construction Engineer, Sergeant, Maxwell Co., New York, N. Y.

J. C. Travilla, Certif. (C.) '86, is Street Commissioner and Member of Board of Public Works, St. Louis, Mo.

E. F. Kenney, '87, C. E. '88, is Metallurgical Engineer, Cambria Steel Company, Johnstown, Pa.

J. C. Irwin, B. S. (C.) '90, C. E. '91, is Assistant Valuation Engineer, Boston & Albany R. R., Boston, Mass.

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M. R. Rogers, B. S. (C.) '93, C. E. '94, is a partner, Alexandria Iron Works, Alexandria, Va.

C. P. Bower, B. S. (C.) '96, is Contractor, C. P. Bower, Railroad Contracting, Reading, Pa.

M. Kind, B. S. (C.) '96, C. E. '99, is Assistant General Manager, Milliken & Bro., Inc., Structural Steel Contractors, New York, N. Y.

J. H. Weinberger, B. S. in C. E. '96, is Engineer of Highways, City of New York, N. Y.

S. Jordan, B. S. in C. E. '97, is President and Treasurer, Stanley Jordan & Co., New York, N. Y.

S. R. Jones, B. S. in C. E. '99, is Structural Engineer, J. G. White & Co., Cranford, N. J.

A. B. Hager, B. S. in C. E. '00, C. E. '03, is Consulting Engineer and Secretary, Fidelity Engineering and Inspection Co., New York, N. Y.

De W. D. Barlow, B. S. in C. E. '01, is Vice President, Atlantic, Gulf and Pacific Co., New York, N. Y.

E. W. Deakin, B. S. in C. E. '01, is Local Manager, Otis Elevator Co., Washington, D. C.

C. H. Kohn, Certif. (C.) '03, is a member of Chas. H. Kohn & Co., Structural Engineers, Norristown, Pa.

F. W. Cooper, B. S. in C. E. '04, is Concrete Engineer and Superintendent, Baker & Knell, Architects, St. Louis, Mo.

L. S. Bruner, B. S. in C. E. '05, is Manager of Publicity, Canada Cement Co., Montreal, P. Q., Canada.

H. A. Hyman, B. S. in C. E. '05, is a member of Waterproofing Construction Co., New York, N. Y.

J. J. Heilman, B. S. in C. E. '08, is Superintendent, Lancaster Machine and Structural Works, Lancaster, Pa.

J. J. Vogdes, B. S. in C. E. '08, is Chief Engineer, Philadelphia Steel and Wire Co., Philadelphia, Pa.

ELECTRICAL AND MECHANICAL ENGINEERING.

Willis Edward Hall, '81 M. E., is a Consulting Engineer, in New York City.

Richard Wistar Davids, '83 E. E., is a Consulting Electrical Engineer with offices in the Land Title Building, Philadelphia.

Henry Price Ball, '88 E. E., is connected with the G. E. Co. at Pittsfield, Mass.

Robert C. Morgan, E. E. '93, has a position with S. A. Jellet, Consulting and Constructing Engineers, in Philadelphia.

James Alexander Stewart, M. E. '94, is associated with the Telephone Company in New York.

Edwin Atlee Garrett, Jr., M. E. '95, is Managing Director and Secretary of the Chemainus Valley Mining Company.

Walter Burgess Warren, M. E. '96, holds the position of Vice President of the Warren Brothers Co., Boston, Mass.

Theodore Bunker, M. E. '96, is an Engineer in the Public Service Gas Company, East Fifth Street Gas Works, Paterson, N. J.

Charles Collins Davis, M. E. '97, holds the position of President of the Penn Forge Company, Philadelphia.

Herman Livingston, M. E. '97, is Superintendent of the By-Product Plant of the U. G. I., Philadelphia.

Harold William Graeff, M. E. '98, is associated with the U. G. I. in Philadelphia, as General Street Main Foreman.

Albert Harris Smith, E. E. '99, holds the position as Manager for the Lehigh Valley Transit Company, Allentown, Pa.

SIGMA XI IN THE TOWNE SCIENTIFIC SCHOOL

David Berger, Ch.; Stephen Douglass Brown, Ch. E.; Loyd Augustus Cross, C. E.; Frederick Sidney Deacon, Ch.; Sylvester Elmer Goodshall, M. E.; Albert Paul Godsho, E. E.; Herbert Vinton Hotchkiss, C. E.; Clarence Kennedy, Arch.; Garner Lee Knox, M. E.; Walter Joseph Lehman, Ch. E.; Russell Bentley Nesbitt, C. E.; Frank Emerson Pennock, Jr., E. E.; Edward John Pugh, Ch.; Wilmer Bruce Rabenold, Arch.; Ross Wesley Ritter, C. E.; Fred Kellog Rowe, E. E.; Harry Menger Wood, E. E.

ARCHITECTURE.

The University of Pennsylvania continues to hold her place of supremacy in the architectural world.

In the Interscholastic Competition, this year, Pennsylvania won more prizes and places than all the other competing schools combined. As a result she retains her standing as the leading school of Architecture in the United States and Canada.

Twelve drawings are submitted by each school, six in Class I and six in Class II. Ten of Pennsylvania's drawings won places out of the twelve sent in for judgment; R. J. Richardson winning the prize in Class I and Walter Antrim in Class II.

The following is a summary of the results of the competition:

Schools competing: Carnegie Institute of Technology, Cornell, Harvard, Illinois, McGill (Canada), Pennsylvania and Syracuse.

The jury made the awards as follows:

"Class I"—First prize, R. J. Richardson, Pennsylvania; first honorable mention, J. A. R. Thomson, Pennsylvania; second honorable mention, W. B. Rabenold, Pennsylvania; mentions—Pennsylvania, C. Kennedy, J. E. Reeb, E. H. Wigham; Harvard, Brown, Kendrich and Stone.

"Class II"—First prize, Walter Antrim, Pennsylvania; mentions—Pennsylvania, A. W. Callanan, E. G. Conrad and

J. T. Wiener; Cornell, Hardie, Kennedy and Kerchberger; Harvard, Keyes.

Not satisfied with such a sweeping victory, the men entered into the Rome Prize preliminaries determined to establish a new record for the American Academy in Rome.

Eight schools entered in the sketch, California, Chicago, Columbia, Cornell, Massachusetts Institute of Technology, Carnegie Institute of Technology, Georgia School of Technology, and the University of Pennsylvania.

Of the fifty designs in competition, Pennsylvania submitted nineteen.

Awards were made by the jury as follows:

W. J. H. Hough, M. S. in Arch. '13, U. of P.

Wm. C. Stanton, B. S. in Arch. '07, U. of P.

J. H. Chillman, Jr., B. S. in Arch. '13, graduate student, U. of P.

W. Pope Barney, M. S. in Arch. '13, U. of P.

Alternate, E. D. McDonald, B. S. Arch. '13, graduate student, U. of P.

Placed sixth in order of merit, W. M. Stanton, B. S. in Arch. '13, graduate student, U. of P.

Pennsylvania receiving every award in the preliminary, the first four men will now compete for the final prize, which gives the winner three years' study in the American Academy in Rome.

The John Stewardson Memorial Scholarship Competition finds only Pennsylvania men competing.

The sketches of the following men were selected by the jury. Named alphabetically and without rank as to comparative merit, they are:

Theo. F. Dillon, B. S. '13, U. of P.

Victor A. Frid, B. S. '13, U. of P., graduate student, U. of P.

John T. Harbeson, M. S. '11.

T. X. Keally, Senior, U. of P.

William C. Stanton, B. S. '07.

.. First Alternate, F. A. Muhlenberg, B. S. '12; second alternate, J. H. Chillman, Jr., B. S. '13, graduate student.

There were twenty-three drawings submitted in the Second Preliminary of the Paris Prize, ten of which were Pennsylvania work. Of the ten awards given by the jury five went to Philadelphia, four to Pennsylvania students, and one to Philadelphia Atelier, whose patrons are Professors Cret and Arnal.

Those retained for the final competition are:

Placed First—H. Sternfeld, University of Pennsylvania.

Placed Second—V. Rigaumont, Carnegie Institute of Technology.

Placed Third—B. Hoyt, Atelier Ware, New York.

Placed Fourth—J. Moscowitz, Columbia University.

W. J. H. Hough, 5th Logeist (placed sixth), M. S. in Architecture, U. of P., 1913.

E. B. Baker, first alternate, Pennsylvania.

J. B. Hays, second alternate, Carnegie Institute of Technology.

J. H. Chillman, Jr., B. S. 1913, U. of P., was placed fifth but having been an alternate of the first preliminary, was placed hors concours.

THE COSTUME BALL.

The first costume ball ever given by students of the University of Pennsylvania, was given Monday evening, March 23, by the students in Architecture, in Weightman Hall.

But who could tell he was entering Weightman Hall, with that dazzling array of colors before him? It proved to be one of the most successful events in the life of the University of Pennsylvania.

Over one hundred couples, including several members of the Faculty, were present in costumes, which were all creations of an Oriental character.

The costumes were well worked out as to design and color, and in nearly every case were originated and made by the students themselves, or their partners. The costumes pictured every nation of the far East, the predominating selections being Turkish, Persian, Egyptian, Indian and Roman.

The large gymnasium was transformed as if by magic into an Oriental garden. The cold, prosaic walls of the gym. were

hidden behind many potted palms, which served to represent avenues of trees. Streamers and flags of Oriental nations were hung from the trusses of the gymnasium. To further carry out the Oriental atmosphere, incense was burned in different parts of the hall throughout the evening.

During the course of the evening small balloons were distributed among the dancers and let loose to float gracefully above the heads of the guests.

Because of the initial success of the Costume Ball, it will undoubtedly become an annual frolic for the Architects.

The patronesses were Mrs. Edgar F. Smith, Mrs. Warren P. Laird, Mrs. Paul P. Cret, Mrs. Charles L. Borie, Jr., and Mrs. R. Tait McKenzie.

The committee in charge consisted of Irving B. Gorman, Raymond J. Richardson, Albert L. Lapachet, Burt B. Minich, Walter J. Frost, Calvin L. King and Jerome L. Weiner.

CHEMICAL ENGINEERING AND CHEMISTRY

THE PRIESTLEY CLUB.

Since the last issue of the TOWNE JOURNAL the Priestley Club has held two monthly meetings. On March 24, Mr. H. C. Miner, Chief Chemist for the Welsbach Company of Gloucester, N. J., spoke on the "History and Development of Incandescent Gas Lighting." The talk was well illustrated with lantern slides and several interesting experiments, and was preceded by a short business meeting. The evening was concluded with the usual refreshments.

The April meeting of the Club was held on Thursday evening, the 23d. On this occasion the speaker was Mr. Henry Wiederhold, President and Manager of the Vulcanite Paving Company, of Philadelphia. The subject of Mr. Wiederhold's remarks was "Asphalt and Its Uses." His talk was amplified by lantern slides and an interesting collection of specimens.

The annual picture of the Club was taken as usual on the Library steps, the Faculty and about one hundred men being on hand.

CIVIL ENGINEERING.

"STEEL STRUCTURAL DESIGN."

An illustrated lecture on "Steel Structural Design" was delivered to the Junior and Senior Engineering students on Friday, March 20, by Mr. H. W. Hodge (M. Am. Soc. C. E.), Consulting Engineer, of New York City.

In his introduction Mr. Hodge characterized the engineering profession as one which deals primarily with things, as differentiated from the medical profession, which deals with men, or from the financial world, which deals with symbols. The advantages of engineering students today was strongly emphasized and words of encouragement and advice were offered, which should be a material help to the embryo engineer, particularly in his early years of experience.

In the illustrated part of his talk Mr. Hodge pointed out the interesting features of some of the largest steel structures in the country. The description of the proposed suspension bridge over the North River at New York City was especially noteworthy.

CIVIL ENGINEERING SOCIETY.

The Civils have held one meeting since the last edition of the Journal. Professor Temple, of the Electrical Engineering Department, addressed the Society on the evening of Friday, March 6. His subject was "Electrical Engineering, Past and Present."

Special attention is called to the annual meeting on Friday evening, May 8. It behooves every last Civil to attend that meeting and help elect officers for next year. A very interesting address has been arranged to follow the meeting.

SMOKER.

A real moving picture show, mingled with Keith Circuit vaudeville acts, greeted the Civil Engineers upon the occasion of their annual smoker on Friday evening, April 3. The program was replete with interesting numbers, from the well-rendered selections of the Komical Kemical Kwartet to the waving of the magician's wand (with the kind assistance of Professor Ingram).

The presence of our beloved Provost and a number of the Civil Engineering Faculty lent dignity to the occasion.

Refreshments were served in the "room across the hall" after the show.

THE CIVIL ENGINEERING DANCE.

The Civil Engineers held their seventh annual dance in the Engineering Building on the evening of Friday, April 24.

The cold, prosaic walls of Room 314 were transformed by the artist's touch into a veritable dreamland of colored lights and flowers. Draperies of pink and yellow bunting graced the walls on all four sides, to be broken only here and there by the vine-covered lattice arbor effects which adorned the windows. Electric festoons of tiny red lights were draped from the centre chandelier to the four corners of the room and produced a most charming and picturesque color scheme when operated as the sole source of illumination. Beneath the chandeliers were hung large baskets filled with roses and Alabama smilax. The far corners were screened off with lattice pergola effects and converted into inviting cozies. The musicians, half concealed with banks of palms and evergreens, occupied the platform in the front of the room.

At least one hundred guests enjoyed the dancing, which continued through twenty-two numbers, until one o'clock. After the eleventh dance the guests retired to the museum room, where a delightful repast was served by a well-known Philadelphia caterer.

In every particular the function was a great success, and one that the Civils may well recall with feelings of pleasure and satisfaction.

ELECTRICAL AND MECHANICAL ENGINEERING

THE HENRY WILSON SPANGLER MEMORIAL SCHOLARSHIP IN ENGINEERING.

The graduates of the Mechanical and Electrical Engineering Department presented the sum of $5000 to the University on February 22, 1914, to found the Henry Wilson Spangler Memorial Scholarship in Engineering. The deed of gift states that "In awarding the scholarship preference shall be given to needy students in the following order: In Mechanical Engineering, in Electrical Engineering, in Chemical Engineering, in Civil Engineering, in any allied branch of Engineering or in Architecture.

Mr. Otto C. Wolf, '76, was chairman of the committee that accumulated the fund. The other members of the committee were H. P. Fry, '95, Secretary; David Haldean, '95, Treasurer; Arthur L. Church, '78; W. J. Serrill, '83; C. J. Dougherty, '92; William W. Scott, '92; H. E. Ehlers, '00; D. Robert Yarnall, '01, and W. C. Gribbel, '05.

"LEONARDO DA VINCI."

"Leonardo da Vinci, Engineer and Artist," claimed the attention of the Junior and Senior Engineers in their fourth monthly lecture, on Friday, February 27.

The talk was given by Mr. John W. Lieb, Past President of the A. I. E. E., Past Vice President of the A. S. M. E., and Vice President and General Manager of the New York Edison Company. Mr. Lieb has devoted a great deal of study to this genius of the sixteenth century, about whom he brought to light many surprising discoveries.

Leonardo da Vinci, who lived in the century 1450-1550 A. D., was a man of universal ability. As an artist he painted the world famous "Mona Lisa," and "Last Supper," besides thousands of sketches of a variety of subjects. He also served as military engineer at Venice and filled whole volumes with descriptions of his inventions, among which the best known is the present day wheelbarrow.

He was a wonderful man, working under tremendous disadvantages; and it is interesting to conjecture what he might have done in the twentieth century.

THE SENIOR INSPECTION TRIP.

During the Easter vacation Professor Fernald took twenty-two Senior Chemical, Electrical and Mechanical Engineers on an inspection trip that included fifteen of the most representative plants in this country. From whatever point of view the trip may be considered, it was a complete success. The plants more than came up to expectations; the comradeship of the evenings in the hotels and sleepers will long be remembered; and the new perspective gained and facts acquired are such important additions

to our knowledge that it is at present hard to realize their full benefit.

Every fellow who took the trip enjoyed it thoroughly and said that he would go again if he had to borrow the money to do so.

WHITNEY SOCIETY.

"The Panama Canal" was the subject presented at the Whitney meeting, held on March 27, 1914. Mr. H. A. Albrecht, the speaker of the evening, added to the interest of the lecture by showing a large collection of his own lantern slides.

Professor R. H. Fernald, head of the Mechanical Engineering Department, was called as an advisor to the Public Service Commission at a recent meeting in the Senate caucus room at Harrisburg, to make rules for the standardization of meters and for uniform service.

Professor Fernald has also been commissioned by the Director of the United States Bureau of Mines to make a three months investigation in Europe, relating to the utilization of low-grade fuels and the recovery and utilization of by-products in the interest of fuel conservation. This is a continuation of the government work with which Professor Fernald has been connected as consulting engineer for the past ten years. He has recently completed a review of certain fuel problems in this country, having spent the summer of 1913 in the Southwest and West and the Christmas holidays in the Southeast. His plans for the coming summer contemplate investigations in Great Britain and the Continent. It is probable that a portion of the time will be spent in Russia.

A Burt Harding, M. E. **'15,** has become connected with the Eastern States Construction Company, Perry Building, Philadelphia, as Structural and Designing Engineer.

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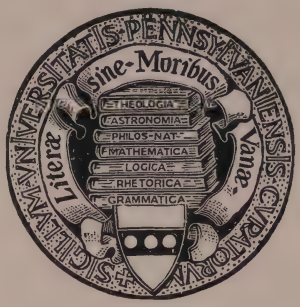

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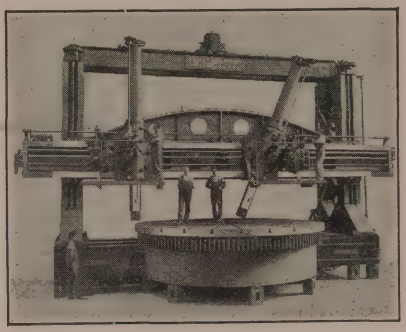

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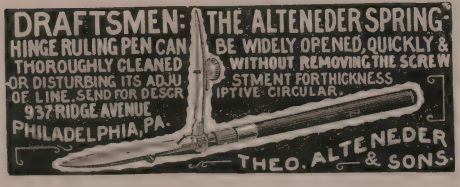

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